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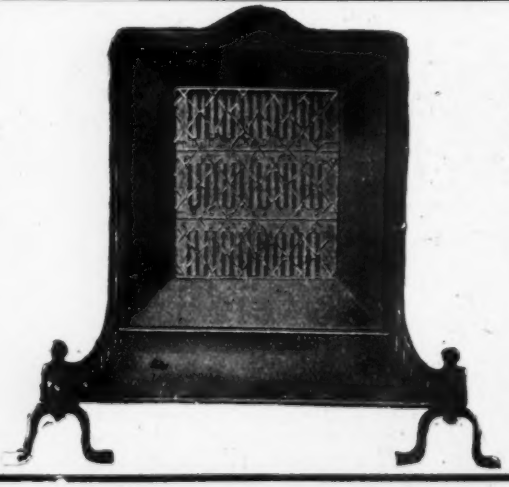

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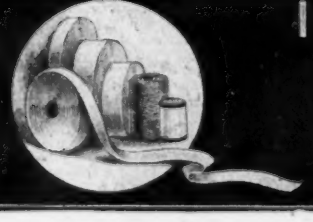

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"HANDS OFF" THE ELECTRICAL INDUSTRY.

JUST over seven years ago the British electrical engineering industry was threatened by Teutonic competition and scheming policies of penetration. Since then much has happened in connection with the industry that we represent, so to improve its resources, efficiency, output capacity, and organisation, as to make it more competent to withstand the assaults of the enemy, assuming that it is not unduly troubled by unsettlement in industrial relations and is not betrayed by those who, in the common interest, should render it protection.

To-day it may be—indeed it is, if the impression on some minds be correct—that the British electrical industry stands in an even more dangerous position in respect of Teutonic penetration than it occupied in pre-war days. The suggestion has been thrown out by Sir Peter Rylands personally—though it was uttered at a meeting of the Federation of which he was for two years president, we believe it in no way represents the view of that organisation or of any special section of it—that Germany shall be allowed to erect and equip our super-power stations; the bait is that they shall be constructed free of capital cost, and thereby allow a cheaper and more abundant supply of electricity to be available for the cheapening of manufacturing production in various classes of trade.

May Heaven save us from so colossal a blunder—traitorous to the dead by whom we live, robbing the living of their means of livelihood, and unmindful of the interests of those unborn for whom the manufacturing industries of Britain must be preserved and strengthened.

In a recent speech, the Premier included among the favourable symptoms of the trade situation, the liquidation of the great glut of products which followed the 1920 boom. Such liquidation would necessarily enable the manufacturing of such products to return to more reasonable activity. He expressed the view that the world needed goods and British goods, and that it would get them.

Since these utterances were made there have been various speeches delivered and articles written in the newspaper Press on the subject of German reparations. Among the suggestions advanced are some such as we have mentioned which appear to be in direct opposition to the Premier's thoughts on the need for the revival of British manufacturing. Those who are advocating that Germany should be allowed to construct super-power stations in British industrial districts are actually proposing that one of the great manufacturing industries of the United Kingdom should be sacrificed in order that our late enemies may be assisted to their feet. Such suggestions do not emanate from British manufacturing circles representative of our electrical interests, of course. Those who desire to see the electrical and allied engineering industries of the United Kingdom in full and profitable employment, are not so foolish as to imagine that such a scheme could possibly redound to the advantage of those industries. They, indeed, know only too well that nothing would give German electro-technical organisations greater delight than the prospect of weakening British electrical industry and gaining a strong Teutonic hold thereon. Germany will find it hard work to regain its favoured pre-war position here, by fair methods in competitive trading. How can anybody acquainted with the past suggest that the future of a vital British industry should be imperilled, as it certainly would be imperilled, by our national legislators approv-

ing of the erection of German electrical engineering exhibits in the United Kingdom? Surely only those can do so who know nothing of British electrical engineering and its ability to-day to fulfil any plant or equipment contract that the world has to offer. Our manufacturers are justified in expecting that new power station work to be executed in the United Kingdom shall be carried out by British labour. British workpeople are justified in looking to such contracts to afford them a means of livelihood for years to come. They know that they will be in sorry plight if those in authority betray them by wrongly using the power that they have given them, to assist German industries, already reported to be very busily engaged, with large contracts for manufactures which we ourselves can make.

The construction of large electric power stations is the most important branch of electrical engineering, as may be gathered from the fact that the cost of a station of 100,000 kW would be of the order of £5,000,000, at present prices; moreover, the key to export trade is construction for home requirements—if we do not build our own power stations, we shall not have the chance of building them for other nations. The designers of machinery must have the opportunity of studying the performance of their productions close at hand, and the manufacturers must have the means for conducting experimental research with a view to improving their products and keeping ahead of their competitors; but above all is the question of loss of employment, in connection not only with the super-power station plant manufactured in Germany for presentation to this country, but also with the orders for plant from foreign countries which would be diverted to Germany. In 1918 the Board of Trade Committee on the Electrical Trades remarked in its report: "The policy of German manufacturers has been studiously directed not only to secure orders in this country under the open competition permitted by our fiscal system, *but also to the effective destruction of British industry*." The policy advocated by Sir Peter Rylands would play directly into their hands.

We were not surprised to see the disclaimer of the Federation which followed on the heels of the speech in the Press the day after it was published.

Let us reprint Sir Peter's statement as reported and the official disclaimer:—

> As to the cheapening of our own costs of production he might refer by way of illustration to the electrical industry. It would be to the interest of this country for the Government to lay down in every industrial centre in this country the best super-power stations at the complete expense of Germany and with an absolutely zero capital cost to this country. The question of the Channel Tunnel also deserved consideration, as he was disposed to believe that the Channel Tunnel would be of great value if it did not cost anything. (Laughter.) He made these suggestions by way of contribution to the question of alternatives to the terrors of an uncontrolled liquidation of the indemnity. (Cheers.)

It is officially stated that in the speech made by Sir Peter Rylands, on the German Reparations, the suggestions he put forward with regard to electrical power stations and the construction of the Channel Tunnel at the expense of Germany, were not mentioned in the provisional reports of the Sub-Committee, and were put forward by Sir Peter Rylands as his own personal views as illustrations of the character of the proposals, and not as specific examples of the suggestions of the Reparations Sub-Committee.

We are glad that this statement was promptly issued. If it had not been forthcoming we can imagine that there would have been a pretty considerable stir in the electrical branch of the Federation. Indeed, we can even imagine the electrical firms having no further use for the organisation, which would have been a pity, for the strengthening, and not the weakening, of the F.B.I. is what is needed.

In an interview that a *Times* representative had with him on Tuesday, Colonel O. C. Armstrong, who is now President of the Federation, said that Sir Peter Rylands introduced super-power station and Channel Tunnel ideas as types of the various forms of payment in kind which Germany could make because, in developing the idea of construction by Germany of works in different countries "he had to search for striking examples to illustrate his meaning, among ideal projects which were not likely to be proceeded with in the ordinary course of development in this country for many years to come." Colonel Armstrong himself regrets that public attention has become centred on these two illustrations to the neglect of what he regards as the more important suggestions which had previously been discussed.

Even Sir Peter would surely desire that these German super-power stations should be erected as far distant as possible from those sacred memorials wherewith we pay public tribute to our immortal heroes who at so great a cost prevented the *Huns* from gaining the Victory after their unforgettably foul deeds. Shall we, after all, allow the Economic Crown to pass to those who proved so grossly unworthy in the eyes of civilisation? Shall we assist to strengthen those very industries which Rathenau organised for purposes of war—the war that came "a year too soon"?

The Germans, by force of arms, designed to rule the world with might. They still design to conquer the world, or an important part of it, economically, but British electrical engineering is capable of running its own business. Let them provide, by way of reparation payments, those things which we cannot make for ourselves and which it is unimportant that we should be able to make in order that we may be safe.

Municipal Refuse Salvage.

In the *Financial Times* of November 18th appeared an article with this heading, by Mr. R. H. Bicknell, M.Inst.C.E., drawing attention to the work of the National Salvage Council, and of Mr. J. C. Dawes, of the Ministry of Health, in connection with town refuse. It seems that the Ministry has just sanctioned the raising of a loan of £200,000 by the Corporation of Sheffield for establishing a salvage installation on a huge scale. The refuse will be screened and sorted, the fine screened dust being used as a fertiliser. The cinder is to be recovered and washed for use as fuel in the Corporation baths and elsewhere; but, so far as we can learn, not for raising steam at the electricity works. Rags, bones, tins, and bottles are to be picked out and sold for re-use. The Sheffield plant is designed to treat 500 tons of dry refuse per day, at an estimated cost of £36,000 a year, against a present cost of £50,000. Neither of the figures includes the cost of collection, which is about £66,000.

It appears that medical officers who have investigated the process on a working model scale have expressed approval of the hand-picking methods referred to, which will be carried out by women and boys. It is stated that there will be a good market for the articles recovered. Mr. Bicknell condemns tipping and dumping (in which we heartily agree with him), and also incineration and pulverisation. But when he says that incineration involves the destruction of useful material and means of power we differ from him. We entertain a strong suspicion of sanitary methods of hand-picking; and we are exceedingly doubtful about the economy of recovering cinder from the bulk by screening and washing, to be sold elsewhere. The Sheffield undertaking, being on such a large scale, will soon prove the economy if it exists.

Our own view is, however, that the best way to realise any fuel value is to turn the material into electrical energy as soon as possible, and if that energy can be used to charge up electric collecting wagons, then, by "washing one hand with the other," a true economy is likely to be realised. But the economy of selling articles separated from the rubbish of the dust bin is dependent on the state of the market, and is, to say the least, a risky business with material that it will not pay to transport very far.

We shall certainly watch the Sheffield undertaking with interest, but at present we do not share Mr. Bicknell's anticipation that at last a final economical solution of the refuse problem has been found.

In our view it is well to screen out the fine dust, which is mostly fine ash completely burned. But it remains to be proved whether it is not better to put all the larger material into furnaces and turn it into steam and electricity at once, rather than to subject it to expensive separation processes, and afterwards to send it away again, at a further cost for transportation, to be used as a fuel. The fine dust should find a market for improving clay land, and the clinker resulting from the burning is valuable for concrete and road making and other purposes.

Trade with Latin-American Countries.

During the course of the war European goods disappeared from the markets in South America, and, in fact, from the whole of Latin America. The United States and Japan sought to enter these markets or to obtain a greater share of the trade with them in the temporary absence of European competition, and a fair measure of success attended their efforts in this direction; but the Spanish-American buyers, always accustomed to the credit conditions and punctuality in delivery of European firms, never took kindly to North American methods, including cash payments or delivery against a confirmed credit in a month, these conditions being frequently associated with uncertainty as to the time of delivery being adhered to and no certainty that the goods would be up to samples or of the quality stipulated in the orders.

Under such circumstances it is no wonder that South American customers again turned their attention towards Europe as soon as possible after the conclusion of the armistice, while on their part the Europeans began to resume their interrupted relations with South America with the hope of recovering the markets. The final result of the rush of European goods and the great activity displayed in 1919, was the glutting of the South American markets with goods or the accumulation at the ports, warehouses, and custom-houses of goods which, owing to the effects of the world economic crisis which had arrived in the meantime, it was impossible to dispose of.

As a result of his own personal observations on the occasion of a visit extending over almost a year in South America, Mr. Kiek, chairman of the Commercial Bank of South America, recently stated that in the still precarious state of international political and economic conditions, it would be futile to attempt to predict the future of the countries with which the bank is associated. Through the opportunities afforded by the war, the United States had displaced much of the British export movement, and now Germany and Belgium were specially cultivating these prospectively valuable markets, assisted by the fateful advantage of depreciated currencies. In addition the American banks and the investing community had latterly entered the lists by more freely granting loans to South American Governments, thus following the policy so successfully adopted in England for close upon a century, of bold, adventurous, and on the whole remunerative supply of capital, which invariably brought direct and indirect returns to British industry and commerce. Such form of co-operation, Mr. Kiek remarked, was welcome, as there was room enough for all. It was, however, essential not to slacken any of our efforts, and the experience of his long journey confirmed the view that, given settled labour conditions at home and industrial peace instead of strife, we should hold our own against any foreign competition if we only remained true to our traditional policy of sound trading, fair dealing, good workmanship, and a respect for and a sympathetic consideration of the Latin-American point of view

As is well known, we exported capital before the war on a large scale in the form of loans to South American Governments, but the bulk took the shape of capital and credits poured into Latin-America by British companies for developing vast tracts of country, the construction of railways and docks, and the organising of public utility undertakings, all of which had materially aided British trade, industry, and shipping. Though we cannot export capital now on the same scale as prior to the war, Mr. Kiek thinks that the time will come when we shall again have similar opportunities, and he naturally considers it to be desirable that these investments should be made by British companies registered under the British flag, so as to ensure that effective control should continue to be exercised in England, and that the many direct and indirect benefits should continue to accrue to British trade and industry.

The Post Office Engineering Department.

Our comment last week regarding the handicap imposed upon a Government Department by the system of promotion by seniority elicited a protest from the Engineer-in-Chief, Sir William Noble, on the ground that that system did not obtain in the Post Office Engineering Department, and as the result of an interview, at which he explained to us very fully the organisation which he has developed, we are bound to admit that his point is well taken. Whilst seniority is not wholly ignored, it is relegated to the background, and certainly does not constitute a dominating factor in the choice of men for advancement in the Service. The keynote of our leaderette was *efficiency*, and we are very pleased to find that the increase of efficiency is the guiding principle in the function of selection.

When a vacancy is to be filled in a position of responsibility, the qualification of the officials who are eligible for the post are minutely examined; of those who are found to be in every way the most competent to fill it, the official with the highest seniority is chosen; but at the same time those who are passed over are informed that they are not necessarily out of the running for future promotion—whether or not they shall be chosen on the next occasion depends upon their own efforts to augment their efficiency and usefulness in the interim. By this means it is sought, and, we understand, with good effect, to make the promotion of an official act as a stimulus to his colleagues, who might otherwise be disheartened by rejection. An obvious objection to promotion otherwise than by seniority is the fear that favouritism may creep in, but this is avoided in the Post Office system by arranging that the decision shall not be left in the hands of an individual, but shall be made on the basis of reports by several officials of higher rank than the candidate, and subject to the approval of the head of the Engineering Department himself.

In order to ensure that the reports above-mentioned shall be based on right principles and directly comparable with one another, schedules have been drawn up by Sir William Noble allotting definite weights to the respective qualifications demanded by the position which is to be filled; these schedules embrace psychological and sociological as well as professional considerations, the relative values attributed to them being varied in accordance with the nature of the duties to be performed—greater weight is attached to strength of character, for instance, in the highest ranks, and to professional skill in the lower grades. The same principles, though in modified form, are observed right through the Department, and every encouragement is given to personal effort to rise in the scale.

One of the most satisfactory features of the system is the fact that it is recognised by the whole body of employés. Trade Unions are notoriously, though mistakenly, averse from permitting the individual to raise his status by efforts in excess of the normal, but the P.O. Union of Engineering Workmen, which is a trade union, unanimously passed a resolution nearly three years ago, declaring that the main considerations that should be taken into account in promoting members were efficiency, good conduct, and seniority, in the order stated. We may add that in the case of men not on the "establishment," efficiency and good conduct are the supreme considerations.

So far as it is humanly possible to eliminate the drawbacks of State control, the Post Office Engineering Department has been relieved of them, and efficiency is its watchword.

D

THE PATH OF A SMALL PERMEABLE BODY IN A MAGNETIC FIELD.

By Prof. W. CRAMP, D.Sc.

In recent examinations a question has appeared to which an answer is not to be found in the ordinary text books. This is the more strange since the case is one of considerable practical importance, and has lately received careful experimental investigation at the hands of Hartog and Belas.

The question may be put briefly thus:—"A small sphere of soft iron is placed at various points in the magnetic field of a straight bar magnet. Draw a series of curves showing the direction in which the sphere will tend to move from these points."

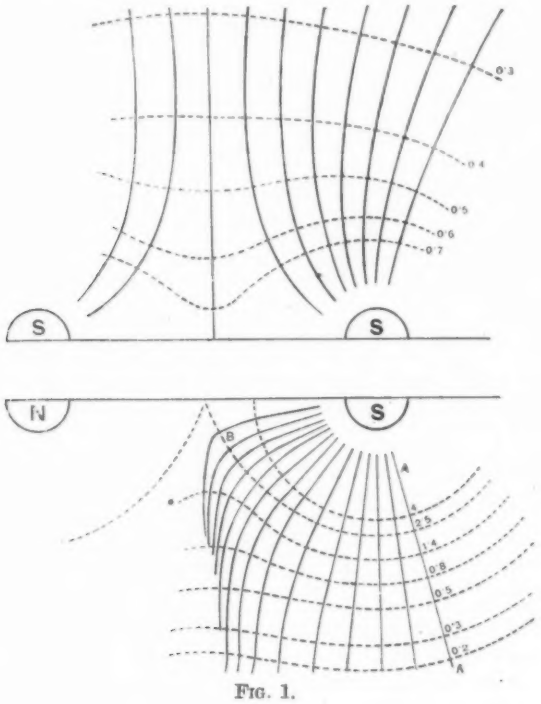

FIG. 1.

Nine out of ten elementary students having drawn a diagram of the ordinary lines of force due to the bar magnet, will reply that the sphere will tend to move along that line of force which passes through the point at which it is placed; and they will probably add that it will move along this line towards that pole to which it happens to be nearer. This answer is, of course, wrong. The lines of force represent those paths along which a particle possessing definite polarity will tend to move. But the sphere is not thus polarised, and consequently instead of experiencing attraction by one pole of the magnet and repulsion by the other, it is attracted by both.

Now, if the south pole of the bar magnet be placed at a distance equal to the length of the original magnet from a similar south pole, a particle having north polarity only would be attracted by both poles, and the paths along which it would tend to move would be the well-known lines for two like poles. These conditions are evidently somewhat similar to those of our question, and consequently the groups of curves in the two cases must have a certain resemblance. This resemblance, however, is only slight, and the cause of the difference is easily seen if we compare the force acting upon a small polarised particle placed within the influence of a field due to a single centre of opposite sign, with that acting upon a permeable particle placed in the same field. In the former case the surfaces of equal potential energy are spheres drawn about the point as centre, and the value of the energy corresponding to any surface is inversely as the radius of the surface. In the latter case, assuming constant permeability of the particle, the surfaces of equal potential energy are also spheres drawn about the point as centre, but the value of the energy corresponding to any surface varies inversely as the fourth power of the radius. For the energy per unit volume of the particle is $\mu H^2/8\pi$, where H, the strength of the field is m/r^2, m being the pole strength and r the radial distance of the particle from the pole. The energy per unit volume is therefore $\mu m^2/8\pi r^4$. Again, as regards force: the force upon the polarised particle will vary inversely as the square of the radius r, while for the permeable particle it will evidently vary inversely as the fifth power of the radius r.

By the usual methods of superposition we may arrive at the surfaces of equal energy and the lines of force due to a *pair* of centres. These I have drawn out in fig. 1, where in order to contrast the two cases sharply, the upper half of the drawing refers to a polarised particle near poles of similar sign, SS, and the lower half refers to a permeable particle near poles of unlike sign, N and S. The energy contour lines are shown dotted, and the figures near them show the relative potential energy corresponding to each curve. It will be noted that in the upper half of the diagram, the difference between one contour and the next is constant, whereas in the lower half these differences vary. This is necessitated by the steep potential gradient occurring near the poles, which renders it almost impossible to keep the differences constant and at the same time to keep the drawing clear. Within the dotted line marked 4, and also to the right of the line marked AA, the contours all become practically circles. The full lines represent paths along which the particle would tend to move. In the upper half of the figure the particle is supposed to have north polarity, and in the lower half to be unpolarised but of constant permeability, the value chosen being 112. All the full lines in the lower diagram are nearly radial within the dotted circle 4, and also to the right of the line marked AA.

The most characteristic difference between the two sets of full lines is the sharp inflection of the lower set about the region B. This is due, of course, to the inverse fifth power law, and the consequent steep gradient.

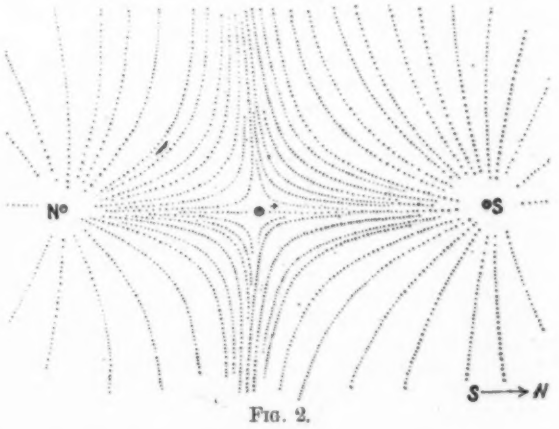

FIG. 2.

In 1916 Prof. Marcus Hartog required a solution to this problem in connection with the analogy which he had drawn between the centred cell forces (mitokinesis), observed in cell division, and electrostatic or magnetic fields of force. Finding no solution in the textbooks, he and Belas devised a most ingenious method for determining experimentally the path of the particle. Their apparatus consisted of a powerful electromagnet of horse-shoe form, with limbs pointing vertically up-

wards. Laid across the ends of the poles was a trough containing glycerine, on the surface of which a small sphere of paraffin containing a quantity of reduced iron was floated. Above the trough a camera was arranged so that the position of the sphere could be focused on to a screen. Upon this screen dots were made with a pencil at the successive points of the screen occupied by the image of the zenith of the sphere which was spotted with black. A photograph of the dotted screen was then made, with the result that the trajectories reproduced in fig. 2 were obtained. The general agreement between the shape of the curves in fig. 2 and the full lines in the lower part of fig. 1 is quite obvious.

In exactly the same way as the field in fig. 1 has been obtained for the action of a pair of unlike poles upon a permeable particle, may another and quite different set of curves be obtained for the paths of a similar particle in the field due to two like poles. In fig. 3, ss repre-

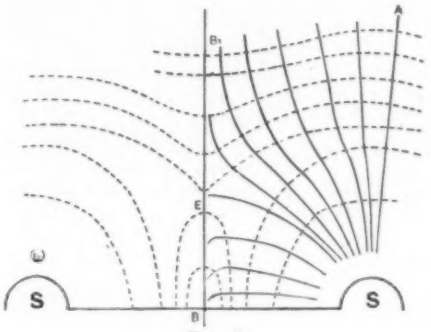

Fig. 3.

sent the positions of two like poles. A portion of the traces of the surfaces of equal energy for a permeable particle are indicated by the dotted lines, and the full lines show the paths which such a particle would take in moving slowly towards the pole. It might at first be supposed that as the diagram for unlike poles resembles the field of force for like poles, the converse would also hold true. But this is seen to be very far from the case. Instead, we have a most interesting series of energy contour lines giving rise to beautiful fan-like trajectories, to which fig. 3 hardly does justice.

If we regard ss as sinks, we see from the figure that there is an elevated region or watershed of which the line B B, is the ridge. The ridge itself, however, is not level, but slopes in both directions towards a critical point E, such that B E/B S=0.708, where B is the middle point of S S. The point E is arrived at by calculating the value of H along B B, which will be found to be proportional to $4a^3/(a^2+l^2)^3$ where S S$=2l$, and a is the distance along B B, measured from B. By differentiating and equating to zero the point E is obtained as a solution to the equation :—

$$2a^6+3a^4l^2-l^6=0.$$

To the right of the line SA all the full lines would be practically radial, and near the centres S S this is also true.

In fig. 4 the results of Hartog and Belas for the case

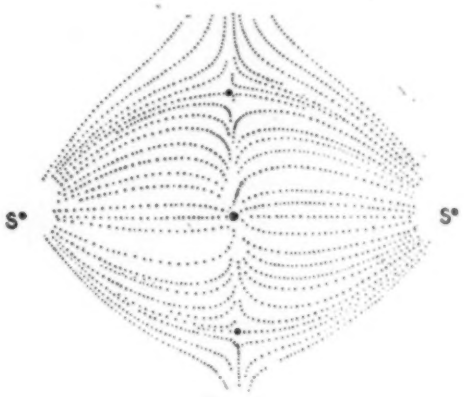

Fig. 4.

like fig. 3 are shown, and once again the agreement is seen to be satisfactory.

In the above discussion, the permeable particle has been assumed to be small, compared with the distance N S or S S. If this is not the case, the introduction of the particle will seriously modify the lines of the figures. This change can easily be calculated for a single source or sink, but becomes difficult when there are two or more such centres. Hartog and Belas have also drawn attention to the lack of symmetry observable in fig. 2, but for such details the reader is referred to their original paper in the "*Proceedings* of the Royal Dublin Society," Vol. XV (N.S.), No. 4, February, 1916. Here it only remains for me to thank them for their kind permission to reproduce figs. 2 and 4 above.

MORE PROPAGANDA WANTED.

By E. S. HODGSON.

The collapse of foreign exchanges has, temporarily at any rate, made it necessary for our large manufacturers of electrical plant and accessories to mark time until the exchange position has been stabilised or until the Government has elaborated its subsidy scheme for industry.

But that is no reason why manufacturers should be idle in other directions; for there is still a great deal of propaganda and "spade work" to be done in the interim.

The Germans, thanks to their low rate of exchange, are taking the utmost advantage of their position and finding access to lost markets and opening up fresh sources for their products. But they are doing more: they have embarked on an elaborate system of propaganda which far exceeds anything they did in that direction prior to 1914, at least so far as the purely publicity side is concerned. They are flooding the markets of the world with catalogues, trade papers, and other material of propaganda, well got-up and printed in the language of the country with which they are desirous of trading. Every trade has its *Fachzeitschrift* (specialised trade journal), the number of general trade journals printed in more than one language have increased, while the German Society of Engineers about a year ago fathered an important publication entitled *Industrial Engineering*, which, printed in German, English, and Spanish, has the avowed purpose of eulogising German achievements in all branches of engineering. This journal is well got up, contains a selection of interesting articles from month to month, and forms in all respects a valuable organ of propaganda.

What are British manufacturers doing in the same direction? Are they utilising their period of marking time in the preparation of foreign catalogues, pamphlets descriptive of their activities, and the publication of journals calculated to give the foreign buyer a comprehensive survey of modern British achievements in electrical and general engineering? Are they training salesmen to go out and study the markets abroad—to do the necessary spade work on the spot?

Every British firm of any importance ought to have salesmen (or, better, representatives) conversant with

their manufactures and equipped with the necessary knowledge of languages to enable them to cope with any and every possible inquiry that they may receive. And not only that: the really successful representative should be able to suggest new uses for electrical machinery and accessories, both to potential users and to his own firm. He should be something of a psychologist, and know something of the art of persuasion; he should have an eye to future developments in countries whose resources have been barely touched as yet; and he should have a head for figures, that he may be able to gauge roughly the cost of any large new undertaking that he cares to suggest. The ideal in this direction would be for a firm or a group of firms to have two representatives in the capitals of countries such as the South American republics—one representative being thoroughly versed in the details of electrical equipment, and the other the linguist, financier and man of the world.

Reverting briefly to the subject of catalogues and illustrated journals as a source of propaganda, the Americans are doing a great deal of useful work in that field. Some of their foreign trade journals are well illustrated—a point of great importance when dealing with the Latin races—and contain articles written from the broad standpoint of utility rather than too specific technical articles. The aspect that interests a nation that has not tried a particular application of electricity, for example, is not so much the technical details as the possible applications of the method to its scheme of industrial development. In this respect, therefore, two or three good photographs and interesting text, hinting at actual and possible advantages, are worth more than all the dry, technical descriptions put together.

To mention one or two possible fields of propaganda, wireless telegraphy and telephony, and power sets designed with prime movers suitable for running on the fuel available in given regions may be cited; also small-scale electric traction, and electrically-driven machinery for performing the operations which in certain countries are now carried out in a primitive fashion.

The function of making a thorough survey of requirements in particular countries or regions would devolve upon the representatives or propaganda agents sent out for the purpose. Nor should the smaller cultivator or farmer or manufacturer be neglected when making such a survey. These people only need to be persuaded of the advantages of electricity for doing their work more rapidly and—in the long run—more economically to get them interested, and the representative with imagination and initiative will quickly suggest the actual means of achieving such advantages.

Some one was bewailing in the daily Press recently that we had no new invention—that one was badly needed, in order to stimulate trade. Well, here is a field wide open and ready for exploiting—the vast and undeveloped regions of South America and other countries which would afford a new outlet for British genius and capital and—propaganda.

MAINS PHOTOGRAPHY.

By A. F. BEACH.

The interesting article "Engineers and the Camera" in the Electrical Review of October 7th, has prompted the writer to pen these notes on the special use of photography to the mains engineer, trusting that this will not be out of place, although the matter is, to a certain extent, supplementary to that article.

Fig. 1.

Fig. 2.

The incident which first caused the writer to use a camera for the purpose of recording the position of a joint hole, illustrates in itself the advantage of this method.

A set of 10,000-volt mains was laid to supply a substation, and a fault having developed, it was decided to cut at a place about half-way along; this happened to come nearly in the middle of a very large field. The plans showed the cables to be laid alongside, and within a few feet of a footpath, this footpath being merely a track worn bare of grass. Digging was started to find the cables at the spot indicated, but none were found, although a trench was cut across the position, and to a good depth.

A trial hole was then made on the other side of the track, and the cables were found immediately. The

path had been moved, probably by someone striking a fresh track, owing to the old one being covered with snow, or perhaps too muddy for comfort, and naturally all later travellers had followed in the footsteps of the pioneer, thus wearing a new path, while the old one was soon obliterated by the growing grass.

When the necessary repair was completed, two photographs were taken of a white staff stuck in the earth over the centre of the joint hole, including as many of the salient features of the distant background as possible, the two photographs being taken from positions roughly at right angles.

A test made a short time later proved this method to be perfectly reliable; a rod set up in a position corresponding with that in both photographs relative to the background was found to be within three inches of the original spot, shown by the hole where it had been stuck in when the photograph was taken.

After this a photograph was taken of every joint hole and cable trench which happened to be in such a position that the location might necessitate the measurement of fairly long distances, or where the objects used to measure from might change or disappear.

It is unnecessary to give further examples of the advantages of photographs for the purpose of recording positions, as every engineer responsible for the maintenance of cables will see how they will apply to his own work, but the two photographs of a joint hole shown in figs. 1 and 2 will illustrate the point.

It may be mentioned that when the writer left the supply company for which this work was done, it was considered of sufficient importance to justify the purchase of a photographic outfit for the use of an engineer for this purpose.

There is obviously no great advantage in using this method to fix positions in town streets, but pictures of complicated pipe or duct arrangements, crossings, and other confusing tangles should be made (from more than one point of view) for office records, before they are buried. In this connection it should be remembered that occasionally a stereoscopic picture is exceedingly useful; this can be easily obtained with an ordinary camera, if there is nothing moving in the subject, by taking two separate photographs from positions about three or four inches apart.

A magazine camera taking one dozen ¼ plates was found to be all that could be desired, and as the light and conditions can seldom be chosen, the work sometimes has to be done on dull days. In practice, the best all-round results were obtained by using slow plates, a very small stop, and a time exposure, a "Century" testing set on its firm tripod being usually used to set the camera on.

THE EXTRA-HIGH-PRESSURE TRANSMISSION LINES CONFERENCE.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

Commencing last week and terminating in the early part of the current week, the above very successful meeting took place in the capital of France. Of late years European engineers have taken much more interest than formerly in extra-high-pressure transmission systems, hence this conference afforded an excellent opportunity of ascertaining their views on the subject—which naturally differ considerably from American practice, owing to the denser populations that they serve and the correspondingly shorter lengths of transmission, compared with American conditions and those of sparsely inhabited countries.

The method of organisation of the conference was to ask twelve countries (excepting Germany and Austria) to appoint official delegates; in addition, the conference invited the attendance of engineers who were interested in the general subject. About 50 delegates attended, those from Great Britain being Messrs. Hunter, Wedmore and Woodhouse. The English guests were Sir Tom Callender and the present writer. Great Britain was honoured by the election of Mr. Woodhouse as one of the vice-presidents. Dr. Kennelly, of the U.S.A., was also elected as a vice-president. The Presidents d'Honneur were Messrs. Blondel (Member of the Institute of France) and Mailloux (President of the International Electrotechnical Commission). The President was M. Legouez. As indicative of the great interest that the French Government is taking in the general subject, it may be mentioned that the proceedings were opened by M. Le Trocquer, Minister of Public Works.

A very systematic programme of work had been prepared, so as to ensure that no details would be left undiscussed. Further, the meetings were so arranged as to be continuous, with no overlapping. In this way, each member of the conference was assured that he would miss nothing, owing to the circumstance of two papers being read at the same time. A week of very hard work was put in, since the proceedings commenced at 9.30 a.m., and with the exception of an interval for lunch, often lasted until 7 p.m. All functions (except that of attendance at the Ampère Centenary celebrations) took place in the evenings; and visits to works, &c., were arranged for the week following the conference.

As main divisions for the discussions, the programme was divided into (*a*) the generation and transformation of electrical energy; (*b*) the construction of the transmission lines; (*c*) the operation and protection of the lines; and (*d*) legislation affecting these works. The papers presented at the meetings were very numerous—amounting to a total of 56. Most of these papers were available in advance, in both French and English—the official languages of the conference. During the course of the meeting a *résumé* of each speech was given in English or French, so that all might understand.

Everyone was enthusiastic as to the success of this the first International Conference on the subject, and it is proposed to make it an annual event. Rumour has it that next year's meeting will be in London.

On Thursday afternoon, November 24th, the Conference was adjourned so that the members might participate in the celebration of the Centenary of the most important discoveries of Professor André Marie Ampère. This afforded a unique opportunity for the study of French character, as illustrated by the manner in which, as a nation, they publicly give honour and praise to their great scientists of the past, whose discoveries have benefited not only France, but the whole world. The meeting was presided over by the President of the French Republic (M. Alexandre Millerand), who was supported by six Ministers, two Under-Secretaries of State, and many others holding prominent positions in the affairs of the country. This brilliant attendance alone was impressive, and showed that France really took to heart, realised, and properly appreciated the valuable work done by Ampère. Readers need hardly be reminded that Ampère was a Member of the Legion of Honour, Professor of Physics, Inspector-General of the University, and Member of the Institute. He was born at Lyons in 1775, and died at Marseilles on January 10th, 1836. In the course of the speeches—which took place at the Sorbonne, University of Paris—there was an amusing rivalry between the physicists and the electrical engineers, each body wishing to claim Ampère's work as being of most importance to the interests it represented. The vast audience was given time to think things over after each speech, while the famous band of the Garde Républicaine played stirring selections—again a typically French custom.

A further insight into French customs was given to the visitors one evening in the form of an old-world French concert, accompanied by musical instruments of the period and also by examples of old dances.

Two dinners were given in honour of the visitors; one by the Union des Syndicats de l'Electricité, presided over by M. Mahieu, Conseiller d'Etat, General Secretary of the Department of Public Works. The other dinner was given by the Société Amicale des Anciens Elèves de l'Ecole Supérieure d'Electricité, with the Under-Secretary of State for Posts and Telegraphs in the chair. Appropriately enough, after the dinner a demonstration was given of the latest developments of wireless telephony. On the following day a journey was made in a procession of 50 Citroen taxi-cabs to the wireless telegraph station at Saint-Assise. This visit was at the invitation of the Société Française Radio-Télégraphique. The portions of the station (*a*) for telegraphy in France and (*b*) to England and the Continent are in operation, while the Intercontinental Station is nearing completion. The last portion of the installation is the largest in the world, larger even than any which are projected; the plant will have a capacity of 3,000 kW. The 16 masts, 500 metres high, are already erected. They are placed in two rows, 400 metres apart, the distance from one post to the next in each row being similarly 400 metres. The pressure of operation on the antennæ will be 120,000 volts. The masts themselves are earthed, there being no attempt to insulate them, as has been the tendency of late. Much interest was taken in the existing machine rooms. Evidently the day of the physical instrument maker for wireless station work has passed away, for this station was hardly distinguishable from a modern rotary sub-station. The modern desk type of switchboard was installed, and the plant consisted of motor generators. These were of two types: (1) to transform the 3-phase, 500-volt a.c. supply to 200 volts d.c., and (2) to transform the 200-volt d.c. current, by aid of a motor running at 6,000 r.p.m., to high-frequency current at 32,400 periods—an abnormally high frequency. These high-frequency alternators were constructed by the Société Alsacienne de Constructions Mécaniques, of Belfort, to the designs of M. La Cour. They are oil-cooled, and each has a capacity of 25 kW. The visitors were given a demonstration of the putting in parallel of two of these sets, which, at their abnormally high frequency, is entirely a different problem to that encountered in ordinary a.c. plant. By varying the frequencies of individual sets, quadruplex telegrams could be dispatched. Four hundred words can be dispatched per minute, and 200 words per minute can be received. The management is aiming at a very prompt service, and the normal time required for the dispatch of a radiogram to London from Paris is five minutes—cases have occurred where the reply has been received in 25 minutes. Should a message take longer than five minutes, rigid investigations are made, but this has not occurred for over twelve months. The new station is being constructed entirely of bricks and cement (so as to avoid electrical troubles due to presence of steel in the constructional work). The arched vaulted brick roof was pointed out with pride, as a novelty in modern building construction—and yet it is only comparatively a few years ago that ferro-concrete construction was itself a new thing.

One evening was devoted to an inspection of the Gaumont kinema film factory. The most recent system of three-colour screen film display was demonstrated, and also the latest development of talking pictures. In both cases the secret is synchronisation by electrical means. A speech by the Minister of Public Works was most realistically rendered. The figure on the screen was greatly enlarged, and the spectator could almost see the words coming from his lips, the synchronisation was so perfect; in fact, but for an occasional flutter of the hand, it was so realistic that the onlooker almost forgot he was looking at a screened film.

The concluding visit took place on Monday, November 28th, to the 200,000-kW power station at Gennevilliers. This plant comprises five turbo-alternators of 40,000 kW each, operating at 1,500 r.p.m. The voltage of the generators is 6,000 at 50 cycles. Stirling boilers, operating at 355 lb. per sq. in., are now being installed, but eventually one half the boiler room equipment will be Stirling and the other half Babcock & Wilcox. Each Stirling boiler has a heating surface of 22,600 sq. ft., and a guaranteed evaporation of 175,000 lb. per hour. The total number of boilers will be 20. Altogether this station is a wonderful example of the very latest ideas in super-power steam station construction.

So far nothing has been mentioned concerning the details of the real work of the conference, and this is for the reason that it has been thought wiser, as this conference was of such far-reaching importance, to give a summary in the form of a separate article, which is to appear next week. There is no question but that this conference has been a great step in forwarding the progress of extra-high-pressure transmission, which is bound to lead to more rapid and better progress, and so, all the sooner, all nationalities will be benefited by a better and cheaper supply of electricity.

A NORTH-EAST COAST LOCAL ELECTRICAL TRADING ASSOCIATION.

In July and August last, meetings were held in Newcastle-upon-Tyne of a committee which sat to consider the formation of a local trading association. The outcome of this was the appointment of an investigating committee, which drew up a report. This document was considered by a committee of interested parties at a meeting held on November 16th, when it was unanimously resolved to accept the report and to send copies of it to each firm represented at the meeting, to the electricial Press, to all associations in the electrical industry likely to be interested, and to any firm making application for a copy.

The Investigating Committee comprised four members representing manufacturers, two representing cable makers, two supply companies, two factors, and two contractors.

The memorandum issued reads as follows:—

In July, 1921, a question arose between the Newcastle-upon-Tyne Electric Supply Co. and the Electrical Contractors' Association as to the granting of trade discounts. The point bristled with so many difficulties and opened out so many controversial matters that the contractors called together representatives of the manufacturers, cable makers, wholesalers, and electricity supply companies, and members of their own body, and laid the matter before them.

After considerable discussion, extending over two meetings, it was recognised that at such a large gathering it was impossible to make progress, and the meeting therefore decided to appoint a committee to investigate the matter.

A committee was therefore formed, and the following terms of reference given for its consideration and guidance:—

"The committee to investigate and consider the advisability of forming a protective association, and the application of the principles of the Bradford Electrical Trading Association to this district."

"The committee finding that a scheme appears to be desirable, to report whether the application shall be (*a*) national; (*b*) local."

At first considerable difficulty was experienced in obtaining an expression of opinion because of the inability of individual members to bind their respective firms or associations. It was, therefore, resolved that, although the various members were appointed as representatives of the B.E.A.M.A., C.M.A., E.W.F., N.E.C.T.A., and the Newcastle Supply Co., this constitution should be dissolved, and each member should express opinions on his own behalf.

At first sight this procedure might give the impression that it robbed the committee of much of its value, but as each member was a responsible party this was not so. This report is, therefore, the considered opinion of responsible individuals engaged in various branches outlined above, and it is hoped will prove of service to the electrical industry.

For the better understanding of this report the agenda is shown itemised, and the committee's conclusions given after each item.

For reasons that will be obvious the committee decided to

refrain from recording in full the arguments put forward, and to confine its report to the bare conclusions arrived at under each heading.

REPORT.

1. Is the present method of trading in the electrical industry satisfactory from the point of view of (*a*) manufacturer; (b) wholesaler; (c) contractor; (d) supply company; (*e*) user?

With the exception of the user each party was represented, and after considerable discussion it was agreed, with one dissentient, that the present method was not satisfactory. The dissenting member thought it was satisfactory "because he knew no better method."

From the users' point of view it was agreed that a better control of the industry might mean higher prices, but this would be offset by greater reliability in the articles bought, and a better service. It was, moreover, felt to be highly probable that these last two considerations would ultimately lead to larger sales, and therefore cheaper production, resulting in lower prices.

2. If the present method of trading is not satisfactory, in what direction does the fault lie?

Considerable discussion ranged round this item of the agenda, and it must be confessed that each group sought, and with some success, to lay the fault at the door of the others. Eventually, however, the following resolution was unanimously agreed upon:—

"We are of the opinion that the question of apportioning blame for the present state of affairs is a matter too large and ambitious for this committee. We, however, offer the following as a formula for further examination.

"The present unsatisfactory method of trading in the electrical industry is due to the lack of sound trading principles and co-ordination.

"We recommend that the various associations within the industry seek to get together to:—

1. Agree the ethics of fair trading.
2. Seek some method of co-ordinating the activities of the industry as a whole to the end of:—

(*a*) Developing the resources of electricity.
(*b*) Encouraging its greater application.
(*c*) Securing a fairer division of profit to each section of the industry.
(*d*) Rendering a better and cheaper service to the public."

3. Can the fault be attributed to any particular group, *i.e.*, the manufacturer, wholesaler, or contractor?

In view of the finding under the previous heading, the committee feels it is invidious to apportion blame to any quarter. Each section of the industry must bear its share of blame, and a recognition of this fact should lead to an earnest endeavour to ameliorate trading conditions.

4. What is the remedy? (Note—Consider a system of grading of buyers by a joint association, as in Bradford).

The committee feels that this is answered by the reply to Question 2. The Bradford Trading Association was carefully considered, and it was unanimously agreed that the committee could not recommend its application.

5. Can the remedy be applied (*a*) nationally; or (*b*) locally?

The committee is of the unanimous opinion that the remedy should be national, and suggests for consideration that local joint committees should be set up for the discussion and settlement of local matters in accordance with accepted principles.

Can the remedy be applied (*a*) wholly; (*b*) at once or deferred?

(*a*) It is too optimistic to hope that the remedy can be immediately inaugurated as a whole. It is felt that the task is a heavy one, and must necessarily be a process of development along accepted lines.

(*b*) The committee sees no reason why the work should not be attempted at once.

GENERAL.

It is possible that there may be an impression that this committee has exceeded the work outlined by the terms of reference, and it might, therefore, be advisable to explain that in considering the advisability of forming a trading association, and the application of the Bradford Association scheme, it was necessary to ascertain whether there existed such a state of dissatisfaction in the industry as to warrant an alteration in present methods of trading. Obviously, if the present methods were reasonably satisfactory, the necessity of altering them fell to the ground, and no consideration of the Bradford scheme was necessary. The agenda was therefore carefully drawn up to take care of this aspect of the case.

As soon as the committee got seriously to work it was apparent that it would be folly to attempt either to outline the dissatisfaction, apportion the blame, or to attempt a remedy. The conditions are national, and the remedy must be national, and it should not lie within the province of a local committee to attempt this work.

All the committee has sought to do is to establish the fact that there is considerable dissatisfaction, which is not confined to any particular section. It has, therefore, sought to find a formula that will merit acceptance by all parties, and influence the various associations to get together with a view to a closer examination of the subject. If this is done in an earnest spirit of goodwill there would appear to be no obstacle to a remedy being found.

Chairman, C. H. MERZ.
Hon. Secretary, SAMUEL C. DAVIS.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Atrax" Projector.

The GENERAL ELECTRIC CO., LTD., has sent us particulars of an effective advertising device which we have noticed at one or two recent exhibitions, where it has proved very "notice-compelling." This is the "Atrax" projector (fig. 1), which consists of a tube 17¾ in. long and 4 in. in diameter, mounted on a base, giving a total height of 19¾ in. A lens is fitted, and the light is provided by a special 100-W "Osram" gas-filled lamp. The picture or advertisement takes the form of a glass slide. The projector tube is mounted on an extension, which slides in and out of the base, and it can be swivelled and fixed at any desired angle through a large range. The image thrown by the "Atrax" projector is so brilliant that it is visible even in diffused daylight; surrounded by other artificial lighting it stands out very clearly.

FIG. 1.—THE "ATRAX" PROJECTOR.

The "Quixup" Cabinet.

We reproduce herewith two photographs of the GENERAL ELECTRIC CO.'s "Quixup" cooking outfit, which we mentioned recently in connection with domestic electrical exhibitions at Messrs. Whiteley's and Harrow. Fig. 2 shows the "open" position with a "Magnet" electrical grill in the

FIG. 2.—THE "QUIXUP" CABINET—OPEN.

centre, and a toaster and a kettle on the side pieces. The cabinet closes up as shown in fig. 3, the aluminium-covered tray being let down on four guides.

In its closed condition the cabinet appears as an ordinary

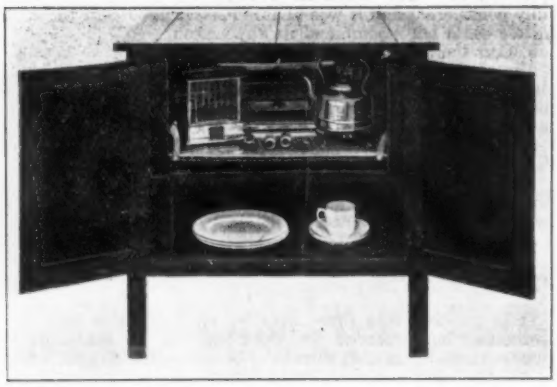

Fig. 3.—The "Quixup" Cabinet—Top Closed.

piece of furniture, and it can be made in any style or wood to suit its surroundings. The set should prove very serviceable in flats or other places where space is precious.

The "Utility" Cooker-Radiator.

The "Utility" cooker-radiator has been designed to provide, at a cost within the reach of all, an electric heating device that is effective and ornamental as a radiator and efficient as a cooker. The sheet-steel frame stands on cast-iron feet, and is fitted with polished aluminium plates on top, thus giving strength combined with lightness. Its weight is 4.5 lb. and dimensions are 12 x 6 x 4.5 in., the consumption being 750 or 1,000 watts. The small amount of metal employed ensures that this robust device quickly reaches its working temperature; the heating coil is mounted on a set of eyeletted mica

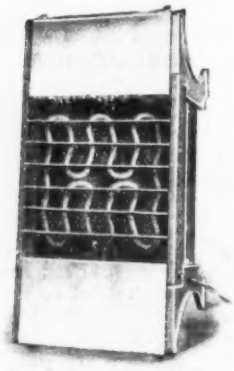

Fig. 4.—The Utility Radiator.

Fig. 5.—The Utility Cooker.

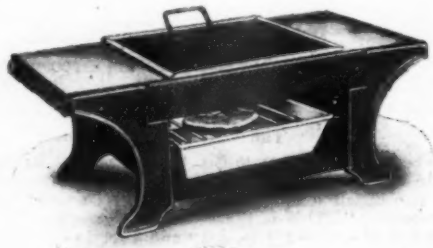

Fig. 6.—The Utility Grill.

supports, which are supported in mild-steel channels. Accessibility is a prominent feature, and by withdrawing five screws, the whole heating element with the terminal block and flex. can be easily removed to allow a new element to be fitted and connected up with the minimum trouble. Sufficient space is allowed at either end of the heating element to enable more than one utensil to be used at a time, as shown in fig. 5; the cooking space is 8 x 6 in., and will boil two pints of liquid in 10 minutes. When standing on end, as in fig. 4, it forms a radiator, or the device may be used as a grill, fig. 6, with a toasting space of 6 x 6 in. A movable polished aluminium reflector plate is provided to throw the heat up or down as required, and we understand from Messrs. Electrical Utilities, Ltd., 1 and 3, Shelgate Road, Battersea Rise, London, S.W.11, that the device is the forerunner of a series of British heating and cooking appliances

Non-Magnetic Cast Iron.

Messrs. Ferranti, Ltd., Hollinwood, Lancs., have produced a non-magnetic cast iron to which they have given the name "No-Mag." This has a higher resistance than iron and a permeability as low as that of brass. The specific resistance is 140 microhms per cm. cube, and the magnetic permeability is 1.03, whilst that of brass is 1. It is therefore very suitable for use in applications where there is a danger of undesirable eddy currents, or where high resistance is required. A leaflet recently sent to us by the firm shows examples of its use, including a transformer cover, weighing 896 lb., an oil switch base, and resistance grids.

DEVELOPMENTS OF ILLUMINATING ENGINEERING.

At the meeting of the Illuminating Engineering Society on November 15th Mr. L. Gaster, in presenting his Report of Progress during the Vacation, recalled that the opening meeting of the session was customarily devoted to reports and exhibits of novelties, and in the course of the evening some interesting new applications of light were shown. Mr. Gaster alluded to various recent official reports as illustrating the interest now taken by Government Departments in lighting. Amongst these may be mentioned the second interim report of the Home Office Departmental Committee on Lighting in Factories and Workshops, the interim report of the committee under the Ministry of Health concerned with the effect of lights used in kinema studios on the eyes of actors, and the third interim report of the Ministry of Transport Committee on Lights on Vehicles. Various outstanding problems, photometric and general, were discussed at the recent first technical session of the International Illumination Commission, notably the ultimate prospect of framing an international code on factory lighting.

Following this a report from the Society's Committee on Progress in Electric Lamps and Lighting Appliances was presented by Mr. Caine, in the absence of Mr. S. H. Callow (Chairman). It was stated that various difficulties with regard to lamp-production recorded last year are now being satisfactorily overcome. Bulbs and tubes of good quality are now available without dependence on foreign supplies. The shortage of suitable reflectors for small gasfilled lamps, which in 1920 furnished one explanation of the tendency to use unscreened lamps in shop windows, has now been removed.

After the reading of these reports, there was a series of short demonstrations, covering a wide field. Mr. W. J. Jones very interestingly demonstrated the use of ultra-violet light (derived from a tungsten arc screened by glass practically opaque to visible light, but permeable to ultra-violet), for testing precious stones. In a dark room most gems fluoresce vividly under intense ultra-violet light; inspection of the colour and intensity of this fluorescence enables an expert to distinguish readily between genuine and imitation stones. It was particularly interesting to learn that by this means one can not only distinguish genuine natural pearls from artificially prepared ones, but also discriminate between the Oriental and the Japanese varieties. These varieties are almost indistinguishable when viewed by ordinary light, but under ultra-violet light the difference in the colour of fluorescence is most marked. In some cases it is even possible to distinguish between gems of the same type, but coming from different districts. This possibility is naturally of great interest to jewellers.

Mr. G. Campbell then exhibited and described several new types of industrial lighting reflectors, the chief feature of which is the careful design of the contour so as to obtain adequate screening of the filament and minimum liability to glare. The latter point is of special consequence in view of the recent recommendations with regard to the avoidance of glare by the Home Office Committee on Factory Lighting.

Mr. Armstrong demonstrated the Grubb motor headlight,* and Mr. W. J. Jones also exhibited a new form of headlight which has been designed with a view to solving the difficult problem of providing a sufficiently powerful beam for driving safely without producing excessive glare in the eyes of approaching pedestrians or drivers of other vehicles.

The next item on the programme was the "Benjamin Lightmeter," devised by Mr. Haydn T. Harrison, which represents one of the latest attempts to provide a simple and portable instrument for measuring illumination. Mr. Harrison pointed out the simplicity of the instrument and its convenience for purposes of demonstration; a small lamp, fed from a portable accumulator, is placed at one end of a box with a whitened interior. One side of the box is cut away and replaced by a strip of opal glass, the brightness of which is a maximum immediately above the small glow lamp, and progressively diminishes as one goes further from the lamp. A small disk of white paper with a central grease-spot can travel along the opal glass plate; the white surface of the paper receives the illumination to be measured, and the

* Elec. Rev., October 7th, 1921; p. 467.

grease-spot is illuminated by light transmitted upwards from the opal plate underneath. Accordingly there will be one position of the grease-spot which gives photometric balance, and this is recorded on a scale, marked out on the opal plate, registering from 0.5 to 20 foot-candles. The paper disk is incorporated in a sliding metal sheath, in which there is also an aperture through which the scale-reading is read. A feature of the apparatus is that it can be inspected simultaneously by several people.

The audience was next treated to a demonstration of the latest developments in "artificial daylight" by Mr. Green and Mr. Lamplough respectively, who dealt with two distinct methods. The "Sheringham daylight" has been described in our pages, but Mr. Green pointed out that an accurate imitation of daylight, suitable for careful colour-matching, inevitably involved a considerable sacrifice of light by absorption. For the latest reflector, however, a much lighter pure blue ultramarine pigment had been secured, and also a better emerald green; a small amount of yellow had also been incorporated in the design, which led to more accurate results. The effect of these improvements was that the efficiency of the apparatus had been approximately doubled. A variety of models, including a portable type with a Sheringham unit and an ordinary glow lamp side by side for purposes of comparison, were shown, and it was mentioned that a trough-type unit had been developed for use in art galleries and elsewhere. This form of unit had been adopted by colour-printers engaged in the production of bank-notes. Apart from its primary use in industries concerned with colours, artificial daylight had proved of value in the grading of flour, rubber, tobacco, and fur.

The method of producing artificial daylight shown by Mr. F. E. Lamplough effects the desired change in colour by passing the light from a gasfilled lamp, equipped with a suitable reflector, through a disk of special Chance glass. With the latest form of glass a light eminently suitable for accurate colour-matching is said to be obtained, and the method lends itself well to the production of a concentrated light. Where extreme accuracy is needed, still greater exactitude in the composition of the light may be obtained by combining the use of an appropriate glass disk with a reflector, the inner surface of which is coloured with a selected blue pigment. An interesting point emphasised by Mr. Lamplough was that an improperly designed artificial light may be *apparently* very similar in colour to daylight, but may nevertheless prove quite misleading when colour-matching. Certain dyed fabrics may appear identical under daylight, but absolutely different in colour under artificial light, and *vice versa*. Mr. Lamplough exhibited a cabinet containing true artificial daylight, spurious artificial daylight of the variety mentioned above, and light from an ordinary untreated gasfilled lamp. By placing selected coloured fabrics under each of the three lights in turn the misleading character of the false artificial daylight was demonstrated.

The other exhibits included some pleasing developments in illuminated signs shown by Mr. E. T. Ruthven Murray, and a display of the new neon lamps now being used for letter-signs * by Mr. H. A. Carter. Mr. Murray's signs are based on the principle of illuminating the interior of a vertical glass plate by means of concealed tubular lights placed along its edges. In these circumstances the light undergoes total internal reflection within the glass, and any device or motto engraved on the back appears vividly illuminated. The latest development is the introduction of colour in such signs, and when operated by a flasher they may be made to reveal pleasing changes in the tint of the lettering. It is also possible to engrave a coloured picture behind the glass. The small neon letter-sign lamps shown by Mr. Carter were introduced this year, and are now becoming familiar. The letters appear outlined in a species of pink glow, and some degree of violet fluorescence is apparent. This gave rise to some discussion on whether such lamps emitted an appreciable amount of ultra-violet light, but it was suggested that the amount of such rays was, if anything, probably less than that met with in ordinary tungsten lamps.

One other small exhibit that deserves mention is the "Luminor" sign described by Mr. Ancotts, which utilises small convex mirror disks, which can be mounted to form various devices. The mirrors have a focusing effect, that causes them to appear as bright spots of light in daylight, and it is claimed that they can be rendered visible even in a very faint light, such as is met with in many streets at night time.

Electric Vehicles at Blackpool.—Owing to the flatness of the town and the excellent road surfaces, Blackpool is generally regarded as an excellent centre from which to operate electric vehicles. It is claimed that in this town "electrics" show better results than in most other places, as, owing to the absence of hills, the most efficient service can be obtained from the cells.

One Blackpool firm of bakers and confectioners is using four electrics with Chloride batteries. One of these batteries has given 2½ years' service, and has been in use for over 9,000 miles, with a minimum mileage of 20 a day.—*Commercial Motor.*

* Elec. Rev., September 16th, 1921; p. 369.

LEGAL.

Workmen's Compensation.

A compensation case was mentioned at Preston County Court last week, in which the applicant was Mary Wilkinson and the respondents were Messrs. Dick, Kerr & Co., electrical engineers.

Miss Wilkinson was at her bench when an electric chandelier, being repaired above her, fell 20 ft. with all the fittings, and struck her in the base of the back. A settlement was reached by payment of £50 and 15 guineas for legal and medical costs.

Weener & Co., Ltd., v. J. B. Berry & Sons.

Mr. Justice Rowlatt, in the Commercial Court last week, began the hearing of an action by R. O. Weener & Co., Ltd., of Water Lane, E.C., against James B. Berry's Sons, Co., Incorporated, Cannon Street, E.C., claiming damages for alleged breach of contract relating to the sale of 800 barrels of transformer oil. Defendants denied the alleged breach, and counterclaimed for £2,237 7s. 2d. on the ground that plaintiffs had refused wrongfully to accept 600 barrels of the oil.

Mr. Harold Morris, K.C., for the plaintiffs, said they were oil merchants and defendants were an American incorporated company with a branch in London. The contract was made in November last year for the sale of 800 barrels of oil. Plaintiffs accepted delivery of 200 drums of oil to satisfy part of the contract, and refused to accept the tender of a further 600 drums. They now claimed damages mainly because the oil was not delivered in barrels but in drums, and they asserted that this was a breach of the description of the goods under the contract. Plaintiffs were merchants only, and had done business with defendants' manager before, and he knew plaintiffs were buying for resale. The damages claimed were the amount lost on the resale, £380, or alternatively, the difference between the contract price and the market price. Defendants set up a defence that they were an American company, and when they put the word barrel in the contract they meant drum, and further that plaintiffs knew drum was meant, because when Americans used the word barrel they meant drum. Therefore there was no breach of contract, and defendants claimed damages against plaintiffs for breach of contract. Defendants set up a second defence that the word barrel was not a description but only a quantity, and a further defence that plaintiffs waived the description. He (counsel) contended that it was quite clear in the contract that it was a description, and plaintiffs were entitled to reject on the day they did, January 10th, because the oil delivered was in drums and not barrels. Counsel explained that transformer oil used for transformers had to be of a very special quality, free from all moisture. A barrel was 55 American or 42 English gallons, containing 3½ cwt. of oil. He added that of the contract quantity of 800 barrels, 400 were rejected because they were drums, and 200 because they were not delivered in the contract time. Barrels were worth about 12s. 6d. each, whereas drums, such as those in this case, were valueless.

Evidence was given in support of plaintiffs' case, and the hearing was adjourned.

The hearing was continued on Wednesday last week, when further evidence was given for plaintiffs that when barrels were contracted for, only wooden barrels would be accepted.

For the defence, Mr. Harold George Furlong, M.I.E.E., a consulting engineer, of High Holborn, and formerly manager of the transformer department of the Ferranti Co., said he had ordered large quantities of transformer oil for that company, and it was essential that transformer oil should be free from moisture; it was the practice of transformer managers not to accept any oil except in steel barrels. Prior to 1914, transformer oil was sometimes put in wooden barrels, and it was due to the enormous amount of trouble on transformers caused by moisture that no oil was accepted except in steel barrels. If he had made a contract for transformer oil he would expect the oil to arrive in suitable containers, by which he meant steel drums. Wooden barrels were unsuitable, because of their liability to shrink and to admit moisture.

Mr. C. H. Wordingham, consulting engineer, agreed that wooden barrels were unsuitable for transporting transformer oil, partly because the wood might contain moisture, partly because the oil might become contaminated by acids from the wood, and partly because the wood might fray and give rise to fabrics which would prove deleterious. It was usual for transformer oil to arrive in steel containers, and if he made a contract for barrels of oil he would expect to receive steel containers.

Mr. George Berry, manager of the British Electric Transformer Co., gave similar evidence, and said the experience of his firm of oil in wooden barrels was disastrous, and they had to insist that all oil was delivered in steel containers. The steel containers in which their oil came were always known as barrels.

Mr. Hamilton Jakes, managing director of Reesoils, Ltd., Newcastle, said that transformer manufacturers and power stations absolutely insisted on having transformer oil in steel barrels. With a contract for barrels of transformer oil he would expect to get steel barrels, but if he were making the contract he would specify steel barrels. His firm would

not supply transformer oil in anything else than steel barrels. It was universal in the trade to put transformer oil into steel barrels.

Mr. William J. Smith, defendants' London representative, said they understood by the contract that plaintiffs required a quantity of 800 barrels, and had no idea they wanted wooden barrels. The steel containers in which the oil was supplied were universally known as barrels in America. His firm would never think of shipping transformer oil in wooden barrels because they knew that no one who understood the trade would accept them. After the contract was entered into, the price of transformer oil steadily declined, and his firm had suffered damage to the extent of the amount for which they counter-claimed.

Mr. Justice Rowlatt, in giving judgment on Thursday last week, said he thought that the word barrel used in the connection in which it was used in the contract, meant a wooden barrel only. But it was said that this oil being transformer oil must be put in steel containers. His Lordship, however, did not think that was right, for it had not been made out that if a little moisture got in, the oil ceased to answer the description "transformer oil." Even if it had been shown to be imperative that transformer oil should be put in steel containers, that did not carry defendants all the way, for if people bargained for barrels, and barrels meant barrels, there had to be made out an overwhelming case before it could be said "in this particular case, with this particular commodity, you can't have meant what the words say." Such an overwhelming case had not been made out. His Lordship did not think there had been any waiver by plaintiffs. From the facts and figures put before him, having regard to the falling market, he was unable to say that plaintiffs had suffered any damage, nor could they claim loss of profits. There would be judgment for plaintiffs on their claim for one shilling, without costs. Defendants' counter-claim must be dismissed, with costs.

The Claim by Mr. A. Siemens Against Siemens & Halske.

According to the *Financial Times*, the Anglo-German Arbitral Tribunal on Friday last gave judgment in this case in which Mr. Alexander Siemens was the claimant and Siemens and Halske were the respondents.

The judgment stated that in 1908 the claimant undertook to transfer to the respondent company 10,133 shares of £5 each in Siemens Brothers & Co., an English company, and in consideration for this was to be made a shareholder of 506 shares of a new issue of shares in the respondent company, Siemens and Halske Aktiengesellschaft, a German company, established according to German law. It was further agreed that the share certificates of the issue which it was not intended for the time being to introduce on the Berlin Stock Exchange should not immediately be printed and delivered, but the claimant was to receive the dividend on the 506 shares, should have the right to vote at general meetings of the respondent company as the holder of those shares, and the respondent company should, on his demand, deliver the documents for the 506 shares to him, or in the event of his death to certain persons named by him, and that then the respondent company would on demand procure the introduction of the new issue of which the 506 shares were a part on the Berlin Stock Exchange. The claimant had received until the outbreak of war the dividends declared by the German company and might have voted, although he did not as a fact do so, at general meetings of the German company. It was urged on behalf of the claimant that in spite of his having received dividends and having the right to vote as a shareholder, no shares had been issued to him, that he never was in fact a shareholder, and that the contract was at the outbreak of the war unfulfilled by the respondent company.

The Tribunal held that the contract contained in the correspondence between the parties was duly performed by the claimant and also by the respondents except as to the delivery of the share documents and the introduction of the shares on the Stock Exchange, but as the claimant had never called upon them to do these things there was no breach of contract in these respects. The Tribunal consequently decided that the claim failed, and awarded the respondents the sum of £75, to be paid by the claimant in respect of the cost of the proceedings.

Telephone Pole Wayleave Case.

In the Victoria Courts last week Lord Ilkeston had before him a case brought on behalf of the Postmaster-General, respecting the rights of property owners to determine agreements for consents given for placing telephone posts on private property and the appropriate annual amount which should be paid by the Post Office for the facility.

A consent had been given in 1910 to the National Telephone Co. by Mrs. Helen Hector, of Edgbaston, for the maintenance of a pole, underground pipe, and stays in the rear of property owned by her at Parker Street, Edgbaston, for an annual payment of £1 5s. In June, 1921, the Post Office engineers renewed this pole on account of deterioration, and without again approaching Mrs. Hector, and it was alleged that some damage had been caused to the property. As a consequence notice under the terms of the agreement was given for the removal of the pole, and the case was taken up by the Postmaster-General under the extended powers granted to him by the Telegraph (Construction) Act, 1916.

Evidence was given on behalf of the Post Office that no complaints of damage or inconvenience had been received from the occupiers of the premises, and that the amount of 25s. previously paid had been agreed to by the National Telephone Co., who had no statutory powers, and that under the conditions as altered by the recent Act, the Postmaster-General was advised that any amount paid in respect of wayleave should bear direct relation to the loss or inconvenience caused by the presence of his fixtures, which in this case was assessed by him at 2s. 6d. per annum.

After hearing evidence, Lord Ilkeston made an award consenting to the maintenance of the fixtures subject to a payment of 2s. 6d. per annum. He assessed the costs of the appeal at five guineas, and directed that they should be paid by Mrs. Hector.—*Wolverhampton Express.*

Postmaster-General v. The Mayor and Corporation of Liverpool.

On November 24th, in the Divisional Appeal Court of the King's Bench, before Justices Shearman and Salter, the appeal of the Postmaster-General from a decision of Judge Thomas of the Liverpool County Court commenced hearing. The original claim was (according to a report in the *Liverpool Daily Post and Mercury*) to recover the agreed cost of repairing certain damage done to telephone plant belonging to the appellant by the electric light mains belonging to the respondents as the electrical authority for the City of Liverpool.

The Attorney-General and Mr. E. Justin Lynskey were briefed for the appellants, and respondents were represented by Mr. F. H. Maughan, K.C., and Mr. Layton.

The grounds of appeal were that the judge misdirected himself and was wrong in law in a number of points.

Further, it was submitted that there was no evidence from which the learned judge was entitled to infer that the plaintiff's plant was laid improperly or negligently, or that the damage to the plaintiff's telephone plant was occasioned or contributed to thereby. It was contended that the judge was wrong in not holding that the damage to the plaintiff's telephone plant was the result of the defendants' acts of nuisance, and that the acts of the National Telephone Co., Ltd., whether amounting to negligence or not, were no defence to plaintiff's claim against the defendants.

The appellant finally submitted that on the facts he was entitled to judgment for the agreed sum of £40 8s. 7d., the respondents' costs of repairing damage in respect of which the judge on April 15th, 1921, directed a non-suit.

Mr. Justin Lynskey, in putting the case for the appellant before the court, dealt at some length with the grounds of appeal, and read the judgment in respect of which the appeal was brought.

Replying to Justice Shearman, counsel for the Postmaster-General said he claimed to be clearly entitled to recover from the Liverpool Corporation damages reasonably following from a nuisance. The only thing which the county court judge in reality found was that plaintiff's telephone cable was almost in contact with the Corporation's electric light cable. In spite of this finding, he contended, appellant was entitled to damages for a nuisance. Briefly, his action was founded on the claim for nuisance, and respondents replied that they relied on the agreement.

One provision in the agreement was that the Corporation was not to be liable for damages caused by electric light wires.

The case was adjourned.

Martin v. London & Cologne S.S. Co., Ltd.

In the King's Bench Division on November 25th, Mr. Justice Rowlatt heard an action brought by Mr. C. Martin, hairdresser and dealer in electrical appliances, against the London and Cologne Steamship Co., Ltd., in which the plaintiff claimed the return of goods or their value and damages for detention, or, alternatively, damages for conversion of goods to defendants' use.

Mr. Stuart Bevan, K.C., for the plaintiff, said the goods in question were a case of electrical appliances comprising two dozen hair dryers and two dozen massage machines. In September, 1920, he bought a quantity of things, including these four dozen articles, from the International Trading Association, and remitted the sum of 30,000 marks in payment. It appeared that the International Trading Association purchased the goods from a firm called Reiss & Graeber, in Cologne, and paid them. It was then arranged by forwarding agents in Cologne that the goods should be shipped to England by the defendant company under a bill of lading dated November 26th, 1920. The goods were to be delivered to the order of the plaintiff, who endorsed the bill of lading and sent it to the defendants for them to send him the articles, and he expected to receive them. Then a Mr. Hart appeared and claimed them. His story was that he had employed the company, who in turn employed the International Trading Association to buy for him, not electrical appliances, but toys from, among other firms, J. Reiss & Graeber, and he had remitted through the company and the International Association 35,000 marks to pay for the toys. He apparently complained to the shipping

company that he had paid for toys he had not received, and that the company ought to deliver these electrical appliances to him. The defendants, having received the plaintiff's bill of lading, against which they were to deliver the goods, proceeded to add a disbursement of 19,564 marks, and so in effect that Mr. Martin could only have the articles if he paid them that sum, and that he would not do. He ought to have had them in time for the Christmas trade.

Mr. Cartwright Sharp, for the defendants, argued that Mr. Martin's money had been applied to some purpose other than that for which he intended it, and that it was Mr. Hart's money which had gone to the payment of these electrical goods; therefore Mr. Martin could not get them unless he reimbursed the money which had been paid by Mr. Hart.

His Lordship said he could see no answer to the claim, and the plaintiff was entitled to the goods or their value. He awarded him a hundred guineas with costs.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Durability of Lead-covered Wiring.

With reference to the controversy which has been appearing in your recent issues as to the durability of lead-covered wiring, the following fact may be of interest to your readers.

I recently had occasion to pull out a length of 19/20 lead-covered cable in connection with the reconstruction of a country-house installation. This cable had to the knowledge of the servants been in for 14 years. Where it passed through a retaining wall it was enclosed in a porcelain duct, but throughout the remainder of its length it had no protection whatever, being run at a depth of 4 ft. through the ordinary soil of the garden. On getting this cable out I found the lead sheathing to be in perfect condition, and the cable appeared to be as good as new.

I think your readers will agree that this speaks well for the durability of this class of cable, and I should be pleased to send a sample piece to anyone interested.

Having had some experience of Admiralty ship wiring also, I have found lead-covered cable of all sizes fixed under some of the worst conditions that it is possible to think of, viz., boiler and engine rooms, navigation lights exposed to all weathers, &c., yet standing up to its work excellently.

I am inclined, with some of your correspondents, to think that workmanship has more to do with the satisfactory working or otherwise of a lead-covered installation than the material itself, and Mr. Allwright has certainly given a list of faults which are constantly found.

W. Lawrence.

Torquay, *November 22nd*, 1921.

The pros and cons advanced by correspondents interested on both the practical and technical sides have proved particularly enlightening, in so far as they prove that the differences of opinion expressed on this important point by engineers depend upon the party they represent, i.e., supply or demand.

Let us take a concrete case. The Alliance Electrical Co., London, used Siemens Stannos wires for external and internal wiring in connection with the installation of electric light in the Covent Garden Market, as shown in your advertisement columns. Any wiring in a market of this description would have to withstand some very rough treatment and would be subject to exposure to all conditions of weather, especially wet walls. Why was a non-lead-covered system adopted in preference to a lead-covered one, if the latter is so very efficient, as "Othello" has it? Why, simply because, as previous correspondence proves, engineers tackling the question from the demand side know lead-covered wiring to have been superseded by modern improvements, and supply using every effort to bias demand. "Othello" undoubtedly is interested in the supply party, whilst Mr. A. J. Abraham and others represent demand. We laymen are largely governed by the actions of the practical men on the demand side, and certainly in view of concrete examples like the present, and an analysis of the correspondence, can only come to the conclusion that lead-covered wiring, whether protected or not, is obsolete.

A Layman.

November 14th, 1921.

As a close observer of methods of wiring extending over a number of years, I have been deeply interested in the correspondence in your columns on the above subject.

Like Mr. W. A. Allwright, I, too, have unfortunately seen installations where the work has been carelessly done, and even "scamped," which, for the sake of the good name of electricity generally, is greatly to be deplored. But there is this to be said for lead-covered wiring—that it is generally easier to detect "scamped" work and have it put right, than it is to deal with such "scamping" in steel tube or wood casing.

Your correspondents who stress the importance of efficient bonding and earthing do so wisely, and with an evident sense of the almost absence of consideration for these important but simple operations, displayed by many "cheap" wiremen-contractors.

I cannot understand why there should be the least difficulty in bonding and earthing. The best of the proprietary lead-covered wiring systems have accessories which make bonding and earthing easy. My experience with those supplied with the Henley wiring system convinces me that no wireman who does not want deliberately to "scamp" his work has any excuse for not doing this essential part of the installation properly and permanently.

In conclusion, I am rather surprised that an electrical engineer like Mr. A. J. Abraham, should, as he did in your issue of the 4th November, advocate any system which can be put in by "the jerry wireman's smallest boy." Mr. Abraham is perfectly entitled to retain his hatred of lead-covered systems, but surely it is not for him, or any electrical engineer, to advocate methods capable of encouraging the army of jerry wiremen. However perfect the system, Jerry will probably botch it, as closely as you like to spend your time in "watching his ends."

W. R. Clements.

London, S.W.,
November 25th, 1921.

Having had considerable experience with this class of work, I should like to say that we have used the Henley system since 1912, and we must have used scores of miles of their cable or Callender's.

These cables have been used in factories, installations of all kinds from public supplies, and private plants; but the bulk of our work consists of country house lighting. We have used it all over the British Isles and on the coast from Cornwall to the Hebrides, and we can find no fault with it in any shape or form.

Among our country-house lighting we have carried out complete installations in many old castles, manor houses, and abbeys, &c., which are built of stone and have no damp-proof courses, whilst in some cases the houses lie so low in the ground that the lawns are level with the windows of the ground floors, and although these houses are naturally damp, we have experienced no trouble up to the present.

Quite recently we made a thorough inspection of an old abbey that was wired by us in 1913, and found the insulation tests perfect and no trace of electrolysis at either switch or fittings ends of the cables or at the bonding. This is a 100-volt d.c. job. There is no trace of chemical action on the sheathing, although most of the cables are run on the surface of stone walls which have been left plain and unplastered.

We have never found this cable attacked by rats or mice.

The main points in erection are absolute continuity of the sheathing with perfect bonding and earthing, careful planning of runs, "feeding out" of cable from the drums, and good workmanship.

We have often been called in to inspect work that has been spoiled by careless workmanship, and we think it is generally that the man is strange to the work, which is quite different to wiring with conduit or casing.

If any contractor or consulting engineer, who is not conversant with lead-covered wiring, would like to inspect any of our jobs, the writer would be only too pleased to fix up an appointment and run him out to see some of our country house jobs or factories.

Rich. A. Parsons.

Gloucester,
November 22nd, 1921.

The majority of your contributors to this interesting correspondence agree that everything is right if the cable is properly bonded throughout by the bonding devices supplied by the makers of the various wiring systems, but, if the naughty wireman omits them, and the wood blocks hide the omission, everything is wrong.

There is, however, one wiring system, a feature of which is that the edge of the bonding ring can be seen at the bottom of the blocks, and the foreman or inspector can convince himself at once that it is properly inserted.

Modesty forbids that I should say which wiring system this is.

F. Charles Raphael.

Ponders End,
November 28th, 1921.

One Solution of the Frequency Problem.

I have read with considerable interest Mr. C. Sutton's article under the above heading in your issue of the 25th November, and whilst the solution may be the most satisfactory when employing the Ljüngstrom turbo-alternator, I cannot agree that the solution as outlined gets over the difficulty *with minimum capital outlay and minimum losses when compared with other alternatives* employing a standard impulse or reaction type of turbo-alternator.

Summarised briefly, Mr. Sutton's scheme, I understand, is to provide a new turbo-alternator unit which can generate its full load output at one of two frequencies or generate at two frequencies with the respective loads split up in any proportion within the capacity limit of the turbine. Also, to provide a frequency-changer available for use with either generating plant installed in the station, and to add this with minimum capital outlay and minimum losses.

An alternative to the scheme outlined by Mr. Sutton would be to employ a standard impulse or reaction turbine and, instead of coupling one alternator only, to couple two alternators in tandem, one of which would be capable of loading the turbine fully at 100 cycles, and the other at 50 cycles, the combined set being capable of :—

1. Giving full load output at 100 cycles, or
2. Giving full output at 50 cycles, or
3. Giving any combination of outputs at 50 and 100 cycles within the capacity of the turbine, or
4. Running as a frequency-changer by shutting off steam to the turbine when the alternators are in synchronism across the bars, allowing the turbine to be run round by the two alternators acting as a frequency-charger. It might be possible so to arrange the turbo-set that the turbine be uncoupled from the alternators and by means of a pony motor the two alternators could be run up as a frequency changer having double the capacity of the coupler set suggested.

The advantages of a scheme of this description are :—

(*a*) Ultimately when the 100-cycle supply ceased the 100-cycle alternator could be taken away, leaving a standard 50-cycle turbo-set.

(*b*) The 100-cycle alternator could be rewound for 50 cycles, and would come in for the next set to be installed, instead of having to be written off as obsolete plant as would be the case with the coupler set and one alternator end of the Ljüngstrom turbine set.

(*c*) There would be no conversion losses.

(*d*) If one alternator only were required the losses in the other (unexcited) would be windage and friction only.

I should expect the capital outlay and losses with a scheme of this description to be considerably better than with the coupler set scheme outlined by Mr. Sutton, not forgetting the question of obsolete plant.

I do not profess to know sufficient of power station management to say whether both or either scheme presents any practical difficulties, and while Mr. Sutton's scheme may be one solution of the frequency problem, it does not seem to me to be all that he claims, namely, *the solution embodying minimum capital outlay with minimum losses.*

As one interested in the sale of impulse turbines I may be unduly biased and will therefore welcome criticism.

E. W. Dorey.

London,
November 28th, 1921.

A Dynamo Problem.

I would suggest that " Electron " carries out the following tests to end his trouble :—

1. Check both ammeters with a standard instrument.
2. See that all switches are ground in on this machine, including the *equaliser switch* and circuit breaker.
3. Examine all nuts, cable sockets, and connections, and see that all is in proper order.
4. See that the ammeters are in circuit in the opposite pole to the equaliser.
5. Examine the shunt regulator and carry out a lamp test on it.
6. Make a pressure drop test across shunt coils and see that they read about the same.
7. Carry out the same test as the above on the series winding.

G. W. L. Wolland.

Norwich.
November 28th, 1921.

Telephone Line Work.

I was interested in the paper by Mr. E. S. Byng on telephone work in America.

Mr. Byng states that 20 men drew 4 miles of cable in 10 hours off 44 drums. Why 44 drums containing 160 yards of cable? A drum must have been placed at every joint box, which, no doubt, would look very pretty on a road or street. Is the time taken in placing these drums, mounting them, dis-mounting and carting away included in the 10 hours? I am afraid not. Also the cable must have been small and attached to the drawing-in wire, instead of their having to draw in a rope; but perhaps in America they place a magnet in the joint box, switch on the juice, and the job's done.

It is also stated that 150-170 pairs of wires are jointed per hour; it makes me sweat writing about it. That is a farce; there would be more crosses and dis's than good pairs, and I should not like to have to test the cable. There are jointers here who can do 60-70 per hour, and the job is done, and they don't have to spend days opening up joints for faults. That man is better than the 100—170 pair man, whom I have never seen, nor anyone else.

It is also stated that the jointers' mates are better. I have had jointers' mates here who could make wire joints as well as jointers, and gave them every assistance, and Mr. Byng has some to-day, but do they get the help given them that they should? No. The paper states that they would. Also I have seen a mile and a half of composite cable drawn into ducts with split couplings (not boxes), and off 3 drums, not 44, in 9½ hours, with 10 men and tackle off job. I am afraid Mr. Byng's paper is a little misleading.

A. E. Tubb.

Birmingham.
November 28th, 1921.

The Profits of the A.E.G.

I venture to suggest that your article on the profits of the A.E.G. is rather severe on the Berlin correspondent of the *Daily Telegraph*. It is no more fair to reckon German profits in sterling than it would be to reckon sterling profits in dollars, or French francs in Swiss francs. To Fritz a mark is a mark, even if its purchasing power is only one-fifth of its pre-war purchasing power.

With regard to the relative prosperity of Germany and this country, one must remember that there are four to five times as many unemployed in this country as in Germany. Which is the more prosperous country?

L. M. Sandison.

Ayton,
November 28th, 1921.

The Installation and Use of Electricity in Coal Mines.

New Regulations and Memoranda have just been issued by the Home Office relating to the above, and several interested bodies have discussed them, such as the Association of Mining Electrical Engineers.

The outstanding features of the new Memoranda appear to indicate that in the opinion of the inspectors, the weak point up to now, of electrical gear as installed in mines, is the switchgear rather than the motors.

There is, however, one problem relative to switchgear which appears to have been entirely overlooked both in the present regulations and in any previously issued, namely, the kVA breaking capacity of the oil switch.

Taking the average colliery equipment supplied with power generated on the premises, the total capacity of the generating plant seldom exceeds 3,000 kVA. Assuming normal conditions of reactance, &c., for turbo plant, this capacity would necessitate the kVA breaking capacity of any oil switch to be, say, 18,000 kVA, and any mining-type oil switch of repute would be capable of rupturing a short circuit on such a system. There are, however, a number of collieries taking electricity supply from a public supply authority. The writer has knowledge of at least two collieries each placed within a mile of the public supply generating stations, one of which stations has a capacity of something like 40,000 kW.

This under similar conditions will require an oil switch breaking capacity of 240,000 kVA, and it is extremely doubtful whether there is any mining-type oil switch on the market which would deal with this capacity.

There is another aspect of the case which should also have consideration, namely, the fact that public supply authorities are admittedly not installing switches on consumers' premises which have the required breaking capacity for the worst possible short-circuit conditions which can apply. This policy may or may not be right, but the attitude of the supply authority engineers appears to be: first, that a short circuit or earth in most cases builds up gradually, and as a consequence, oil switches are seldom required to break what is really a dead short circuit.

Secondly, even should the short circuit be of such a nature as to damage the oil switch, the latter will in most cases rupture the circuit and if it is badly damaged or destroyed in doing so, the monetary loss incurred by the destruction of an oil switch occasionally is nothing compared with the increased capital cost which would be entailed in installing oil switches up to the full breaking capacity in every case.

This line of argument is reasonable for surface work where the explosion of an oil switch, enclosed as a rule in sheet steel or stonework cubicle, is not likely to cause either external damage or loss of life.

The consequences of the explosion of an oil switch below ground are very different, and in the case of a colliery taking power from a public supply, it might be necessary to install oil switches on the feeder circuits below ground, which were very much larger than the supply company's main switch.

It would be hard to convince any colliery company that this was necessary, but nevertheless such might undoubtedly be the case if the spirit of the Mines Regulations were to be lived up to. It is doubtful whether colliery electrical engineers have ever really considered this question of oil-switch breaking capacity, but it appears to be one of first importance from the safety-in-mines point of view, and it is a question which should be seriously considered in view of the present-day tendency to take electricity supply from large bulk sources rather than to install separate isolated stations.

There is no doubt that the risks of explosion on switchgear are considerably greater where the supply comes from a bulk source as against a supply which comes from a small private station, and if colliery installations are going to be

connected to the huge industrial networks which will be the vogue in the future, would suggest this matter be given very careful consideration in order to avoid the possibility of accidents which might damage the reputation of electricity supply in general.

F. G. Travis.

Manchester,
November 28th, 1921.

Electricity in Isolated Buildings.

The article under the above heading by Mr. E. H. Freeman is most interesting, but one may question if the whole contribution is not of the nature of an apologia. In any case the matter submitted, though excellent, gives undue precedence to one class of plant, and does not sufficiently or comprehensively review the whole of this important subject.

The class of plant, *i.e.*, non-automatic, so enthusiastically described by Mr. Freeman, is unquestionably a sound proposition when the work is properly carried out. Such installations, however, usually apply to what may be termed the larger country houses, establishments with anything over 100 lights, and a fair power load. This class of resident, however, does not by any means represent the average country dweller, who with the small automatic plant, now on the market, may enjoy equal felicity in an electrical sense to that of the bigger folk. In the past, it is to be feared that many non-automatic plants have merely comprised a "general-purposes" farm engine belted to a high-speed dynamo, the whole outfit being only suitable for battery-charging, duty calling for much attention.

The descriptions and illustrations of representative "non-automatic" installations put forward by Mr. Freeman are undoubtedly excellent, but the refinements enumerated are bound to involve the owner in relatively large expense. To best meet any extensive country demand for electricity is required an isolated plant to deal with 30 to 40 lights and small-power duty, suitable for installation in any existing outhouse (or even a basement), to be simple in operation and maintenance, and to require no special attendance. This matter of attendance is all-important, for by no means every country dweller has a gardener or odd-man about the place. Without doubt, it is the relatively low cost of installing, with the minimum amount of attendance required, that is responsible for the large sale of the "automatic" type of plant. In fact, if very many present owners of small plants of the automatic type had been compelled to go to the expense apparently involved in the case of jobs illustrated in Mr. Freeman's article, there would have been no sale!

Many disputable points are raised by Mr. Freeman, *e.g.* relative efficiencies, fire risk, correction of defective cells, overcharging of battery, voltage, supply of appliances, &c., where it may be said that the automatic plant is in no way inferior to the non-automatic type. A further argument advanced, that those attending to any automatic plant forget the existence of lubrication, fuel supply, and general cleaning is peculiar, as this could not be done unless such party were deliberately careless. The list of plants given is noted to be in error in one or two instances at least; moreover, it is very far from complete. It may also be said that numbers of automatic plants have been in operation for at least 10 years, so that this proposition may be taken as proven.

On the power side the position is equally clear, and the method usually recommended of running the generating set when there is a power load (motors, radiators, &c., up to the capacity of the plant) is quite sound, as any excess current over that actually required may pass into the battery, and thus there obtains a most economical system of working. Certainly, such a method of operation, or the handling of lighting load in an equivalent manner, is justifiable, and is an infinitely better proposal than a mere battery-charging proposition. Apart from this, it is an indubitable fact that the majority of average installations of the kind in question are primarily for lighting duty, the power side being more or less a side-issue.

As suggested in the foregoing, the various plants—full, semi, and non-automatic—have their respective fields of application. There is, however, little doubt but that the advent of the semi-automatic plant in this country has brought much additional business to the electrical trade—business that would have been wholly lost were such alternative not available. Semi-automatic plants, in particular, more closely meet the general demand for small country-house electric lighting than any other type as, with the relatively small wiring job attached, they more closely fit the average country dweller's pocket. A commentary that applies to the situation is contained in a recent traveller's report, which states: "This firm's country-house work has been in handling large jobs only, but as this class is about worked up Mr.. . . .is now considering small plant jobs, of which he is likely to get quite a few." One may believe this rather bold statement just about represents the present-day state of affairs.

Marshall Tate.

London,
November 26th, 1921.

Unemployment and the Cure.

In your issue of October 28th, in the article entitled "Unemployment and the Cure," it is stated that it is foolish to attempt economies by reducing the selling price. This does not seem to me to make sense with the context, and it has occurred to me that perhaps there has been a mistake, and that "price" should read "force." We should then have: "The fatuity of attempting to economise by reducing the selling force is manifest." With that I think everyone will be in agreement.

Quester.

November 28th, 1921.

[Our correspondent's suggestion is correct. The word "force" was incorrectly printed as "price."—EDS. ELEC. REV.]

BUSINESS NOTES.

Notice to Advertisers.—The attention of advertisers is directed to an announcement which appears in our advertisement pages to-day, respecting the dates for sending in "copy" for our issues of December 23rd, and 30th.

Bankruptcy Proceedings.—T. RAWSTHORNE, electrical engineer, 67b, Paradise Street, West Bromwich.—Receiving order made November 21st on debtor's own petition. First meeting, December 9th, at the Official Receiver's Offices, 191, Corporation Street, Birmingham. Public examination, December 14th, at the Law Courts, West Bromwich.

S. H. DOUGHERTY (Mersey Electric Co.), electrical engineer, Liverpool.—Last day for proofs for dividend, December 9th. Trustee, H. W. Bowler, 30, North John Street, Liverpool.

J. SMITH & SON, electrical engineers, 1, Central Street, E.C.—Receiving Order, November 24th. First meeting, December 7th. Public examination, February 7th, both at Carey Street, W.C.

W. BENNETT, electrical contractor, Back Sitwell Street, Derby.—First meeting, December 7th, at the Official Receiver's Offices, 4, Castle Place, Nottingham. Public examination, December 20th, at the Court House, Derby.

C. P. M. DOWNIE (P. Downie), electrical engineer and factor, Southend-on-Sea.—Last day for proofs for dividend December 14th. Trustee, T. Gourlay, 29, Russell Square, W.C.1.

J. HARRISON (Harrison & Son), electrical engineers, Southend-on-Sea.—First and final dividend of 3¼d. in the £, payable December 9th, at 29, Russell Square, W.C.

G. H. GEE, electrician, 10, Front Street, Annfield Plain, Durham.—First and final dividend of 2s. in the £, payable December 7th, at the Official Receiver's Offices, 4, Northumberland Avenue, Newcastle-on-Tyne.

Company Liquidations.—NATIONAL ELECTRIC TIME CO., LTD.—Meeting of members is called for January 2nd at 18, Queen Street, E.C., to hear an account of the winding up from the liquidator, Mr. A. C. Vincent.

PRITCHETT & GOLD & ELECTRICAL POWER STORAGE CO., LTD.—Meeting of members called for December 30th at 50, Grosvenor Gardens, Victoria Street, S.W., to hear an account of the winding up from the liquidator, Mr. A. M. Woodward.

ELECTRICAL & ENGINEERING DEVELOPMENT, LTD.—Winding-up voluntarily. Liquidator, Mr. D. J. Longden, 67, Broxash Road, London, S.W.11, who is authorised to enter into an agreement with Electrical Utilities, Ltd., on terms stated.

ENGINEERING DEPOTS, LTD.—Particulars of claims must be sent to the liquidator, Mr. C. H. Wells, 21, Fargate, Sheffield, by December 31st.

Dissolutions of Partnership.—S. G. COZENS & Co., electrical engineers and contractors, 63, Queen Victoria Street, E.C. Messrs. S. G. Cozens, R. Grose, and E. G. Coombs have dissolved partnership. Messrs. S. G. Cozens and Mr. E. G. Coombs will attend to debts and continue the business.

LOWNDES & STEVENS, automobile, electrical and mechanical engineers, Trafford Park Garage, Manchester.—Mr. E. Lowndes and Mr. E. J. Stevens have dissolved partnership. Mr. Stevens will attend to debts and continue the business under his own name.

Trade Announcements.—We are informed that MESSRS. T. E. NANKIVELL and S. E. GRUBB have resigned their directorships of the STANDARD ELECTRICAL & MAINTENANCE CO. (SEMCO, LTD.), and are not now connected with the firm. Messrs. C. E. Rapson and E. F. Burrill are the remaining directors.

THE ANTI-ATTRITION METAL CO., LTD., have closed their city offices (35, Queen Victoria Street, E.C.), and have opened more extensive offices at 1, Victoria Street, Westminster, S.W.1.

The Faraday Electrical Installation Co. are commencing business at 173 and 174, Railway Approach, Shepherd's Bush, London, W.12, and they wish to receive trade catalogues and terms from manufacturers or suppliers of installation accessories, &c.

Mr. Cecil Howlett, Jun, has resigned the position of manager of the electrical department of Messrs. Wellman Bros., and is again commencing business as an electrical engineer at 16, Victoria Street, Windsor, in partnership with Mr. L. Ryan as Howlett & Ryan.

The Cable Accessories Co., Ltd., are holding stock in London at their new address referred to last week (13, Cursitor Street, E.C.4).

Messrs. Shaw & Co., of Manchester, have taken over show and sale rooms at Booth Street West, All Saints, Manchester, where they will hold weekly auction sales of electrical goods and machinery.

Catalogues and Lists.—British Insulated & Helsby Cables, Ltd., Prescot, Lancs.—A catalogue of jointing materials, tapes, compounds, paint, &c.

Messrs. Johnson & Phillips, Ltd., Charlton, S.E.7.—"Transformer Abstracts," an illustrated booklet giving descriptions of a number of types of transformers. The publication is designed to aid salesmen.

Venner Time Switches, Ltd., 45, Horseferry Road, Westminster, S.W.1.—A folder illustrating four types of time switches for shop window use, &c.

The Titan Lift Co., Ltd., 20, High Holborn, W.C.1.—An illustrated catalogue describing a number of types of passenger lifts, engines, controllers, &c.

Mr. Alfred E. Dean, Leigh Place, Brooke Street, Holborn, E.C.1.—A priced and illustrated catalogue of X-ray apparatus, including coils, switchboards, interruptors, couches, portable sets, tube stands, &c.

The Relay Automatic Telephone Co., Ltd., Marconi House, Strand, W.C.2.—A booklet illustrating a 50-line "Relay" installation, with notes on various parts of the system.

Messrs. Higgs, Bros., Sand Pits, Birmingham.—Monthly magazine for December, containing stock lists of a.c. motors and d.c. dynamos and motors, notes on shafting, humorous items, &c.

Electrical Utilities, Ltd., 1 & 3, Shelgate Road, Battersea Rise, S.W.11.—Priced leaflet, C.R./1, illustrating and describing the new "Utility" cooker-radiator

The Chemical Engineering Co. (Manchester), Ltd., 49, Deansgate, Manchester.—An illustrated pamphlet giving a description of the "Kek" densimeter, a simple device for continuously indicating the density of water in steam boilers, by the balancing of a column of distilled water against a column of boiler water.

Book Notices.—"Blue Printing and Modern Plan Copying," by B. J. Hall, M.I.Mech.E. (130 pp., 65 figs.). London: Sir Isaac Pitman & Sons, Ltd. Price 6s. net.—This publication deals very fully with a subject of the first importance to engineers and architects. A large number of systems are described, and comparative costs are given, of daylight printing, various types of printing by artificial light, the use of the photostat, photo-mechanical copying, &c. An appendix treats of the preparation of drawings for photographic line blocks. The illustrations are of value in ensuring a proper understanding of the text.

"Electric Lighting in Factories and Workshops," by Gaster and Dow (37 pp.). London: The General Electric Co., Ltd. *Gratis.*—This booklet deals with the effect of lighting upon the efficiency and well-being of workers; the cost of lighting in relation to the cost of production in a factory; the ascertainment of the amount of lighting necessary; and types of lighting systems. Illustrations of actual applications are included.

"Ypres to Verdun," a collection of photographs of the war areas in France and Flanders, specially taken by Sir Alex B. W. Kennedy, F.R.S. 84 pp., 124 plates. London: Country Life, Ltd. Price 15s. net.

"Pattern Making," by W. R. Needham, pp. iv+114; 171 figs. London: Blackie and Son., Ltd. Price 2s. 6d. net.

"A First Book of Applied Electricity," by S. R. Roget. Pp. vii+143; 89 figs. London: McMillan & Co., Ltd. Price 2s. 6d.

"Rays of Positive Electricity and their Application to Chemical Analyses," by Sir J. J. Thomson, F.R.S. Pp. x+237; 41 figs., 9 plates. London: Longmans, Green & Co. Price 16s. net.

Underground Railways Joint Committee.—A Joint Committee representing employers and employed is being set up to deal with wages and conditions on the Underground group of railways. This machinery will be similar to that which exists on the trunk railway lines, and is in accordance with the recent agreement made between the companies and the mens' Unions.—*Morning Post.*

German Activity in Spain.—As has already been stated, German trade propaganda is very active in Spain, and German commercial travellers are to be seen there as busy as before the war. German trade papers in the Spanish language are circulated widely among the commercial community. H.M. Consul at Vigo contrasts this with the fact that United Kingdom publications received are still usually printed in English, and therefore, as far as the Spanish commercial community is concerned, serve no useful purpose.

The Lyons Fair, 1922.—British manufacturers and traders should take note that the Spring Fair at Lyons takes place from March 1st to 15th, 1922. No words of emphasis should be needed to-day to impress our readers with the importance of this event from the international trading point of view. In previous Fairs, quite a number of British electrical engineering firms have taken a very practical interest, and we have no doubt that many of them will desire to embrace the opportunity which will present itself a few months hence, of displaying their products before the eyes of our friends in France and of the large number of buyers from other countries who will make Lyons a rendezvous in March. British exhibitors will be taking part in the British Industries Fair in London and Birmingham at about the same time (February 27th to March 10th), but the Lyons opportunity is not one that should be missed, and we recommend our firms to get into touch with the British representative of the Lyons Fair, at 31, Budge Row, London, E.C.4., who will furnish all particulars including the conditions, &c., under which it is possible to have a stand of one's own including space, erection, and lighting and heating, for a total outlay of about £100.

The E.P.E.A.—Report of National Executive Council.—The report of the N.E.C. of the Electrical Power Engineers' Association, published in the *Electric Power Engineer*, expresses regret at the small number of "industrial" members who have joined the Association. It was debated whether to drop this section or to enlarge the Association's scope to include all engineers who were connected in any way with electrical engineering. The following resolution was adopted:

"That in the opinion of this Council the policy as now laid down by the S.T.E. is detrimental to the best interests of our industrial members, and therefore unless some modification can be made in this policy in consultation with this Association, the activities of the E.P.E.A. shall be extended to embrace the whole of the technical staffs engaged in the design, manufacture and erection of machinery used in the generation, utilisation and distribution of electrical energy."

It was also resolved that the whole of the technical engineering staffs of electric railways and tramways be eligible for membership. The Council decided to make subscriptions the same for all branches. The "sick leave" clause embodied in the Schedule is still a cause of differences; it is therefore to be reconsidered and, if necessary, revised. Mr. Essex has been added to the number of the Association's representatives on the National Joint Board, making the total seven. A draft schedule of salaries in undertakings of less than 1,000 kW capacity has been drawn up, and is still under the consideration of the N.J.B., and it will be submitted to the District Boards. It has been decided to become affiliated to the National Federation of Professional, Technical, Administrative, and Supervisory Workers, and two delegates are being appointed. Until the Council has definitely decided upon the nature of the qualifications to be required of applicants for membership of the Association, the rule relating to the passing of the A.M.I.E.E. examination is to be held in abeyance. The diversity of conditions relating to the positions of charge engineers in various undertakings has militated against a satisfactory arrangement of grading. The suggestion of the formation of a mutual benevolent fund has received approval, and the N.E.C. has decided to fix a compulsory annual subscription of 5s. per member. The question of unemployment has proved a serious one. The N.E. Division has instituted a voluntary levy of 2s. 6d. per week upon employed members for the benefit of those out of positions. The other sections have been circularised upon the subject, and, at the same time, the Management Committee is considering the matter.

Dundee Corporation Contracts.—A committee of Dundee Corporation is considering the advisability of inserting in contracts a model clause to meet rises and falls in prices. In the course of discussion of the matter a member expressed the view that contractors would not supply the Electricity Committee if a clause covering reductions in prices were included in the contracts.

Dutch Enterprise in Germany.—A short time ago a Dutch company was formed under the title of the Reuss Electricity Co, of Amsterdam, to acquire the undertaking of the firm of Vogel & Muller, of Gera, who were engaged on the construction of electric motors and the extensions of installation work, &c. The share capital amounts to 500,000 florins, out of which shares for 200,000 fl. are now being offered by a Dutch Bank Association for subscription in Germany.

French Companies.—Société Hydroelectrique de Luz St. Sauveur is the title of a company formed with a capital of 300,000 fr. for the production and utilisation of electric energy. Its offices are at 115, Cours d'Alsace-Lorraine, Bordeaux.

There has been established at Paris (76, Faubourg Saint-Antoine) the Société Française des Etablissements Nioca, with a capital of 1,400,000 fr., for the manufacture of insulators and electrical apparatus.

There has been formed at Paris (56, Faubourg Saint Honoré), the Société de Reconstruction d'Usines Sinistrés Groupement Energie Electrique du Nord de la France, Société Roubaisienne de l'Eclairage par le Gaz et l'Electricité, with a capital of 1,000,000 fr. for the rebuilding of factories in the devastated regions.

Illuminating Glassware.—The Board of Trade has given notice that, in exercise of the powers conferred upon it by Part II. of the Safeguarding of Industries Act, 1921, it has referred to a Committee constituted for the purposes of that part of the Act, and consisting of Sir William Ashley, Ph.D. (chairman), Mr. J. Arthur Aiton, C.B.E., Sir Thomas W. Allen, Sir John N. Barran, Bt., and Mr. F. R. Davenport, a complaint by the British Flint Glass Manufacturers' Association and the National Flint Glass Makers' Society, that articles of domestic glassware, illuminating glassware, and mounting glassware, manufactured in Germany and Czecho-Slovakia, are being sold or offered for sale in the United Kingdom at prices which, by reason of depreciation in the value in relation to sterling of the currency of the above-named foreign countries, are below the prices at which similar goods can be profitably manufactured in the United Kingdom, and that by reason thereof employment in the glass industry in the United Kingdom is being or is likely to be seriously affected.

The Committee proposes to hold its first sitting for the taking of evidence at 2.30 p.m. on Monday, December 12th, 1921, at the Hotel Windsor, Victoria Street, London, S.W.1. The Secretary to the Committee is Mr. W. G. Fergusson, Board of Trade, Great George Street, London, S.W.1, to whom all communications should be addressed.

English as She is Writ—in Germany.—We have been privileged to see a copy of a circular issued by a Berlin export firm offering metal-filament lamps for sale in the British market. We reprint it as an interesting example of trade literature "Made in Germany":—

Conformable the surrounding prices and conditions of delivery J am in the situation, to day to deliver large posts of

m e t a l - t h r e a t - l a m p s

first german quality, with edison ore svan-brass-socle in execution of peace

if you superscribe your ordres going about.

J foot at this offert upon large conclusion wich J did place early.

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J advise to you, an quick resolution therewith you can become the purveying still this season.

Yours very trully

Down in the right-hand corner are instructions to the reader "*please to turn round,*" otherwise turn over and see on the reverse side the list of prices at which these "metal-threat-lamps, half-wat-lamps gas fillt, and glimm-lamps of light propaganda" are offered.

German Metal Interests.—According to *The Times*, Dr. Emil Hirsch, head of one of the world's biggest metal groups, has been in London on a visit from Germany; also Herr Hugo Stinnes endeavoured while he was in London to secure large quantities of steel scrap for his German works.

Unemployment.—The latest available information shows a further increase in the total of unemployed persons, the figure for November 18th being 1,817,000, as against 1,789,432 a week earlier. There was a slight decrease in the number on "short time." On June 24th last the total of unemployed was 2,177,899.

Local Electrical Exhibitions.—Mr. Rowberry, a local electrical contractor, arranged an electrical exhibition on November 17th and 18th, at the Memorial Hall, Wellington (Hereford). The hall was artistically and effectively lighted by lamps of many designs and domestic appliances of all kinds were exhibited. These included, cookers, tosters, vacuum cleaners, irons, an "A.B.C." washer, &c. There were also motors for various purposes, such as farm work, and pumping, and an electric drill was shown in operation. Wellington is one of the places covered by the Hereford rural electricity scheme.

An exhibition of domestic electrical appliances was held last week, under the auspices of the Holmfirth (Yorks.) District Council, at the Council offices, and Mr. H. H. Parker, the Council's electrical engineer, gave explanations and demonstrations daily.

At the Blackpool Trades Exhibition, which concluded on November 30th, there were some interesting electrical exhibits. Two of the best-stocked stands were those of Mr. George Morrison, electrical engineer, of Birley Street, Blackpool. This display included vacuum cleaners, an electric washer, radiators, electric irons, kettles, and coffee percolators, &c. Another good display was that of Messrs. R. Darbyshire, Ltd., electrical engineers, of Upper Talbot Square. One stand was devoted to a demonstration of the "Magicoal" electric fire. Another novelty by the same firm was a Christmas "log fire," made of painted earthenware.

Employment in Lead Processes.—The Home Secretary has recently issued further Statutory Rules and Orders under the Women and Young Persons (Employment in Lead Processes) Act, 1920 (Nos. 1,713, 1,714, and 1,715, H.M. Stationery Office, 1d. net each). The first defines the expression "lead compound" used in the Act. The others relate, respectively, to medical examinations and welfare (accommodation, &c.).

Forthcoming Exhibitions.—The following exhibitions are being organised:—

London.—February 27th to March 10th, 1922, British Industries Fair; March 1st to 25th, 1922, Ideal Home Exhibition.
Manchester.—January 2nd to 13th, Trades Fair and Market.
Birmingham.—February 27th to March 10th, 1922, British Industries Fair.
Cardiff.—May to October, 1922, Welsh National Exhibition.
Canada (*Winnipeg*).—February 6th to 11th, Motor Show.
Belgium (*Brussels*).—April 3rd to 19th, 1922, Commercial Fair.
France (*Lyons*).—March 1st to 15th, 1922, Spring Fair.
Holland (*Utrecht*).—February 21st to March 3rd, 1922, International Fair.
Italy (*Milan*).—April 12th to 27th, International Sample Fair.
Spain (*Barcelona*).—March 15th to 25th, 1922, Samples Fair.
Switzerland (*Basle*).—April 22nd to May 2nd, Sample Fair.
Trieste.—May, International Sample Fair.
United States (*New York*).—January 15th to 25th, 1922, General Merchandise Fair.
Japan (*Tokio*).—March 10th to July 31st, International Peace Exhibition.

Belgian Companies.—"Mexinel" is the style of a company just formed at Brussels (13, Rue du Canal), with a capital of 400,000 fr., for the manufacture of electric and other kinds of heating apparatus.

With a capital of 1,250,000 fr. has been constituted at Forest, Brussels, the Compagnie Industrielle et Commerciale d'Electricité for the trade in and manufacture of electrical and other material.

Vanneukerke Gebroeders is the style of a company constituted at Gentbrugge (253, Brusselschen Steenweg), to carry out electrical installations.

There has been formed at La Hestre the Etudes Industrielles Raymond Evens & Co., to undertake electrical and other manufactures and general electrical operations.

Fire.—A fire broke out on Thursday afternoon last week in the building in which the Tudor Co.'s London offices are situated. Although the fire spread to the Tudor Co.'s premises it did not originate in their offices. Five of their staff had to dash through the flames to effect their escape, but before doing so stayed long enough to ring up the fire brigade. Naturally the fire tended to dislocate the Tudor Co.'s business, but the excellent efforts of all the staff have resulted in no matters suffering more than 24 hours' delay.

Denationalised Russian Industries.—The British Agent at Moscow has informed the Department of Overseas Trade that, according to a decree issued by the Russian Soviet Government, all undertakings in Russia which were not *de facto* nationalised before May 17th, 1921, are to be considered as denationalised and the owners are immediately to be reinstated. In view of the possibility that certain British-owned undertakings may fall within the scope of this decree, British firms interested are invited to communicate the facts to the Department of Overseas Trade in order that the necessary inquiries may be made through the British Agent.—*Daily Mail.*

Public Supply Superseded by Private Plant.—Messrs. Willys Overland Crossley, Ltd., have sent us a copy of a letter from Messrs. Tom Norton, Ltd., of The Automobile Palace, Llandrindod Wells, stating that they have changed over their supply from the town mains to a supply from a Willys light set, which is running satisfactorily. The makers also inform us that owing to reduction in the manufacturing costs they have been able to make a material reduction in the price of the generating set, as well as in that of the complete outfit, from December 1st.

China's Import Tax.—The Chinese Government has sent a memorandum to the Legations requesting permission to increase the Customs tariff, bringing the present 5 per cent. up to 7½ per cent. The tariff at present in force was agreed to by China and the Powers many years ago, and China is requesting an immediate sur-tax, raising the tariff on all imports, until the revision is completed. If the Powers agree it would considerably ease the financial situation. If successful the Government intends to raise a loan of about £6,000,000. —*Daily Mail.*

E.D.A. Activities.—We were surprised recently to receive a telegram announcing "House burned down, dinner as usual —Doris," but on further examination were relieved to find that the message was upon the front cover of an E.D.A. booklet. This purports to be a letter from a lady to a friend explaining how, in spite of the destruction of her house by fire, she managed to cook a dinner for her husband with a rescued electric stove, upon the lawn. The Association has also sent us a copy of a poster. Upon a background showing a power station appears the exhortation: "Do it the electric way," "Saves more than it costs." A price list of publicity matter has also reached us.

Aluminium.—The British Aluminium Co., Ltd., has issued a sheet giving tables of information regarding aluminium. This gives the weight per unit of aluminium wires, tubes, sheets, bars, strips, &c., with notes on the relative physical and mechanical properties of aluminium, brass and steel, and particulars of aluminium alloys.

Electricity Supply Commercial Association.—The address of the general secretary of this association has this week been altered to 227, Well Hall Road, Eltham, S.E.9. All future communications should be sent there.

Chinese Notes.—The Hung Yau Electric Co. is to raise $20,000 capital to install an electric light plant in Heiho within a period of three months.

Lead.—Reporting on November 26th, Messrs. James Forster & Co. stated: "Makers of sheet and pipe lead report a little better inquiry, but this trade is far below normal, some of the most important works barely working half time. The electrical trades are also a little busier, but in neither case is there anything like normal work. For export there has again been considerable inquiry. On the other hand, supplies are very short, due to the absence for some weeks past of Spanish imports."

LIGHTING AND POWER NOTES.

Alderley Edge.—Price Revision.—The Alderley and Wilmslow Electricity Supply Co., Ltd., has applied to the Electricity Commissioners for a special order for the revision of the maximum prices authorised under the orders of 1895 and 1903, and for other purposes.

Australia.—Launceston (Tasmania).—The annual report of the Electricity Department for the year 1920-21 shows a total revenue of £37,435, as compared with £30,478 in the previous year. The total expenditure amounted to £34,678 (£28,468). There was a surplus for the year of £2,757.

Bingley.—Electricity Extensions.—The District Council has decided, subject to approval by the Electricity Commissioners, to accept tenders for the supply of a small engine and alternator, for which application is to be made to borrow £500. The plant is intended to generate electricity for the town during the brief periods when the overhead supply line from Keighley is "dead" for overhauling purposes, with a view to having more frequent overhauling and testing to avoid the repeated breakdowns which have occurred during the past.

Blackrock (co. Dublin).—Electricity Supply.—The Urban District Council has accepted the offer of the Irish Overseas Direct Trading & Electric Lighting Association for the supply of electricity to the district. The scheme will be completed within two years.

Continental.—France.—A message from Grenoble to the *Journée Industrielle* says that a number of hydro-electric concerns have formed a group for the purpose of establishing a large system for the distribution of electricity in the south-east of France and the Massif Central. The companies concerned are the following: Compagnie Electrique de la Loire et du Centre, Compagnie Hydro-Electrique d'Auvergne, Société des Forces Motrices de la Loire, Aciéries et Forges de Firminy, Société des Forces Motrices de la Truyère, and Union Electrique. The group has taken the name of Société de Transport d'Energie du Centre, and has its headquarters at Saint Etienne, 14, Rue du Treuil. The State was asked to grant a concession for a system of transmission of electric power linking up the numerous hydro-electric works of the above companies.

Details of the lines in the first section are as follows: three-phase current, frequency 50, pressure about 120,000 volts, possibly 150,000; minimum transmission capacity: Cantal-Loire feeder 25,000 kW; Loire-Auvergne feeder between St. Etienne and Roanne 25,000 kW and between Roanne and Commentry 15,000 kW.—*Reuter's Trade Service* (Paris).

The Union des Gaz at Vésinet, Seine-et-Oise, has decided to substitute an underground system for its present overhead high-pressure service of single-phase current at 2,700 volts, using in its stead three-phase current at 10,000 volts. The company has just received a provisional authority to set up four of these lines for one year, preliminary to its applying for a concession for the whole of its network.

Belgium.—An intercommunal association comprising 30 communes has been formed at Bouge with the object of providing electricity in the area. Plans have been invited for the installation of a generating station and high and low-pressure networks.

Owing to the lengthened drought the Canal of Willebroeck has sunk so low as to prevent the working of some of the machines at the municipal power station at Brussels. In consequence restrictions on the general consumption of electricity have had to be imposed.

Poland.—The completion of the water-power installations for the former province of East Prussia is now impending, which will render the province independent of coal for electricity purposes. According to the *Wasserwirthschaft*, water power stations are to be built at Friedland and Gross-Wohnsdorf, on the Alle river, and these are expected to be completed by the end of 1923. The diversion of the Alle is already in hand for the supply of water power to an auxiliary station, which will be able to supply electricity by December. Near Friedland a huge reservoir is to be built capable of holding some 20,000,000 cu. metres, with a surface area of 4.2 sq. kilometres. A reservoir will also be built near the power station at Gross-Wohnsdorf capable of holding some 4.7 million cu. metres and of 2.3 sq. kilometres surface area. The two stations will yield in an average year about 34,000,000 kWh.

Greece.—A strike of power-station employés, last week, put Athens in darkness. Later the strikers were joined by the tramwaymen and gas-workers. The Government announced its intention of putting sailors to work in the power stations.

A *Reuter* message dated November 27th stated that the strike had been settled and a number of the strikers accused of sabotage had been awarded severe sentences by courts-martial. —

Spain.—The Spanish Government has lately granted a concession for the establishment of a plant to utilise the water power of the River Duero, near Aldeafuente (Province of Soria) for generating electricity for lighting and power purposes.

Darlington.—Price Reductions.—The engineer and manager of the Corporation Electricity Department (Mr. J. R. P. Lunn, M.I.E.E.) informs us that under the new rates, shortly to be put into operation, lighting supplies will be 4d. per unit, a reduction of ½d. The last 10 per cent. increase on power rates will be withdrawn. These reductions will bring the lighting rate to within 14 per cent., and the power rate to within 33 per cent., above the pre-war rates.

Grampian Scheme.—Public Notice.—Public notice has been given under the Private Legislation Procedure (Scotland) Act, 1899, of the intention to form a company to carry out certain hydro-electric works in the Grampian District of Scotland. The works are fully set forth and the Petition and Draft Order are to be lodged on or before December 17th.

Huddersfield.—Year's Working.—The income of the electricity department for the year ended March 31st last was £212,161, and the expenditure, excluding charges for interest, £173,432, the gross surplus being £38,729.

India.—The Poona Hydro-electric Scheme.—Work on the Tata hydro-electric scheme near Poona, which involves the flooding of a large area occupied by farms and villages, for the formation of a great reservoir for the supply of water power, has again been postponed, this time until December, owing to the continuance of the passive resistance tactics of the inhabitants.—*Reuter* (Bombay).

Jersey.—Street Lighting.—The St. Helier Town Council has decided to endeavour to replace the present gas-lighting of the town by electricity. A number of French engineers are in the island, and will bring forward a scheme to utilise sea-water power.—*Daily Telegraph.*

Leatherhead.—System of Supply.—The Electricity Co. has applied to the Electricity Commissioners for permission to make the standard voltage of supply to all future consumers within its area 220 volts between one phase and neutral, and, at its option, to alter the supply to any existing consumers within the area from 110 to 220 volts. The cost of replacement or alteration of any apparatus on consumers' premises necessitated by the change will be borne by the company.

Newton Abbot.—Time Extension.—The Ministry of Transport has consented to the extension until August, 1922, of the time in which the Council has the option to acquire the local electricity undertaking.

Rugby.—Municipal Trading.—The local Building Trades Employers' Association recently complained to the Electricity Committee that the electricity department was carrying out installation work to the detriment of contractors' interests. It was suggested that the Council had no legal powers to do this. The committee found that under the Rugby Water and Improvements Act, 1901, powers for this purpose were conferred. Nevertheless, the committee recommended that the Council should cease to carry out installation work. When the recommendation came before the full Council it was defeated, and a decision to carry on with the work was made.

Runcorn.—New Station.—On November 25th the wife of the engineer and managing director of the Mersey Power Co. opened the company's new station at Runcorn. The plant comprises two 12,500 kW turbo-alternators generating 3-phase current at 6,600 V, supplied by Messrs. C. A. Parsons & Co. The boiler plant consists of three B. & W. water-tube boilers with superheaters, economisers and chain grate stokers. The switchgear, of the remote control type, was supplied by Messrs. A. Reyrolle & Co., and the cables from the station were made by British Insulated & Helsby Cables, Ltd. This plant is the first part of a large installation. The station is capable of accommodating plant of 100,000 kW capacity.

South Africa—Grahamstown.—Subject to the consent of the ratepayers and the Administrator the Council has adopted a scheme for the supply of electricity to the town at an estimated cost of £65,000.

Salisbury (South Rhodesia).—The annual report of the Electricity Department shows a revenue of £19,206. The total expenditure amounted to £18,105, leaving a profit of £1,101.

Todmorden.—Year's Working.—The annual report of the electricity department shows a loss of £5,223 during the past year, as compared with a deficit of £3,774 in the previous year.

Truro.—Electricity Supply.—The Town Council, after considering an electric light scheme by which it is proposed to take a bulk supply from the Cornwall Electric Power Co., has asked the company to revise its sliding scale of prices, which it was felt would adversely affect the scheme during the first few years.

Yeovil.—Time Extension.—The Ministry of Transport has approved the extension, by one year, of the Electric Lighting Order of 1914.

TRAMWAY AND RAILWAY NOTES.

Bristol.—Proposed Railless Cars.—The Corporation has under consideration the running of railless electric cars to Hotwells and Avonmouth. The city engineer has reported favourably upon this system as compared with a tramway. The road improvements necessary would involve the expenditure of £93,000; the cost of constructing a tramway track, as originally proposed, would have been £176,000.—*Commercial Motor.*

Chile.—Railway Electrification Contract.—The Chilean Government recently ordered from the Westinghouse Electric International Co. the equipment required for the electrification of the State railways between Valparaiso and Santiago and the Los Andes branch, a total route mileage of 144. The rolling stock is to comprise eleven local passenger locomotives, fifteen goods traffic locomotives, six express locomotives, and seven switching engines. The system, which is direct current at 3,000 V, will be supplied by five 4,000-kW sub-stations. A traffic increase of 50 per cent. is allowed for. The value of the contract is 7,000,000 dols.—*Railway Review.*

Continental.—Belgium.—Owing to certain dismissals, the Brussels tramway employés ceased work last week. To meet the needs of traffic 'bus services were instituted and operated by volunteers.

Norway.—According to a notice in *Tidens Tegn* of November 3rd the Kristiania Elektriske Sporvei A/S (Electric Tramway Company) has decided to extend its Lilleaker Line to Stabaek. The extension of this line, which now terminates at Oraker, will cover a distance of about four kilometres. Work will be commenced as soon as possible.

France.—It was estimated that the working of the six tramway undertakings in Paris, which were acquired by the City Council in conjunction with the General Council of the Seine Department, and leased as an amalgamated concern to an operating company at the beginning of 1921, would result in a loss during the first five years under the new management, which would have to be borne by the General Council. It is now foreseen that the deficit will amount to 85,000,000 fr. for the present year.

Edinburgh.—Tramway Electrification.—The Town Council has not yet decided upon the method to be adopted in electrifying the tramways along Princes Street. Mr. R. S. Pilcher, the tramway manager, puts forward three methods. One is for the track to be on the south or garden side of the street, with side pole and bracket arm construction; a second method is on the north side; and a third along the centre with centre poles. He points out that the Ministry of Transport will not, however, sanction centre poles in Princes Street. The conduit system, with Brussels or London types of plough, is also dealt with.

Mr. Pilcher recommends the conversion to the electric system throughout the city without further delay. His report states that the working of the Leith electric system costs 4.20d. per car mile less than the Edinburgh cable system, and that over the area of the cable system represents £98,000 per annum on the present mileage. This saving in working expenditure would not only meet the capital charges on the cost of conversion, but would leave £53,365 to meet renewals and provide for the reduction of fares.

Glasgow.—Tramway Purchase.—The Tramways Committee has recommended that an offer of £200,000 be made for the Paisley and district tramway undertaking. In the event of the offer being confirmed and accepted it is intended to link up the undertaking with the city system.

Halifax.—Revised Fares.—According to the *Yorkshire Post* the Tramways Committee has decided to abolish the fare transfer system and to establish penny stages, each of which will be half the length of the present 2d. stage. It is hoped that, as a result, there will be a large increase in revenue.

Hull.—New Route.—The Town Clerk has been instructed by the Corporation Parliamentary Committee to apply for a light railway order for the extension of the tramway system to Hessle.

Leeds.—Light Railway.—The Tramways Department has decided to start the laying of the light railway track from Harehills to Oakwood in about six weeks' time.

London.—Lower Fares.—The action of the L.C.C. in restoring the penny fare on the London tramways has led the L.G.O.C. to come into line on routes covered by both 'buses and tramcars, although it is stated that the company cannot afford to make the reduction general. The Underground Railway Companies have decided not to make any immediate reductions in fares, as it is their stated policy to encourage the use of surface transport by short-distance passengers, the railways being intended, primarily, to serve the outer districts of London.

Bermondsey.—The L.C.C. Highways Committee has again had under consideration the future of the old horse tramways in Bermondsey. Electrification had previously been discussed, but, owing to the heavy expenditure involved, and to the fact that the probable traffic would not be large enough to be remunerative, it was decided to defer the matter. Now, acting upon a resolution of the Bermondsey Borough Council, the committee recommends that the track be taken up and the road reinstated.

Manchester.—Proposed Electric Railway.—Two Manchester engineers have put before the Lord Mayor and the Chamber of Commerce a scheme for the construction of an electric railway from Heywood to South Manchester and Styal, a distance of 25 miles. The *Manchester Dispatch* gives details of the route, which would have 24 stations or halts. The line would connect with the L. & Y. Railway at Heywood, and would embrace two-thirds of Manchester. The estimated cost is £1,500,000. The suggestion is made by Messrs. J. W. Welch and James W. Newton, of Victoria Buildings, Manchester.

Middlesex.—Extension of Company's Lease.—At a meeting of the County Council on November 24th the application of the Metropolitan Electric Tramways, Ltd., for a further 20 years' extension of its lease was considered. The Highways Committee was in favour of negotiations being entered into for the extension of the lease, which expires in 1930, and the Committee's recommendation was approved. The company desires this extension to enable it to recoup expenditure which it proposes to make upon improvements and renewals.—*Daily Telegraph.*

Rochdale.—Railway Electrification.—The L. & Y. Railway Co., having notified the Corporation of its intention to electrify the line between Manchester and Oldham, the General Purposes Committee has decided that the desirability of extending the electrification from Oldham to Rochdale be urged upon the company.

South Africa.—Railway Electrification.—It is understood that the Government has decided on the electrification of the Glencoe-Maritzburg line.—*Reuter's Trade Service* (Capetown).

United States.—New York.—Among the objectives of the Transit Commission of New York City, recorded by the *Electrical World*, are: the municipal ownership of all railway lines within the city; the surrender by the holders of all existing "franchises"; the unification of all systems and the appointment of a board of control to secure that all payments for property to the present companies are made on a proper valuation—not "book" values; the construction of new subways; and to secure the participation of employés in the surplus profits.

Wicklow.—Closing of Tramway Route.—The County Council has decided to close the Dublin and Blessington tramway in the Wicklow area.

TELEGRAPH AND TELEPHONE NOTES.

China.—Telegraph Service.—The report on the working of the Chinese Post Office for 1920 reads, in part, as follows:—To its various activities the postal service has added the acceptance and delivery of telegrams at places not provided with telegraph offices, and telegrams can now be accepted at 1,320 places and delivered at 10,000 places which were formerly outside the sphere of the telegraph service.

India.—Importation of Apparatus for Wireless Telegraphy.—The following Customs circular has been issued by the Government of India, Department of Commerce: "In exercise of the powers conferred by section 19 of the Sea Customs Act, 1878 (VIII. of 1878), and in supersession of the notification of the Government of India in the Department of Commerce and Industry, No. 5120-73, dated July 14th, 1909, the Governor-General in Council restricts the bringing by sea or land into British India of any apparatus for wireless telegraphy to cases in which (1) such apparatus is imported by any person to whom a licence to establish, maintain, and work a wireless telegraph has been granted under the first proviso to sub-section (1) of section 4 of the Indian Telegraph Act, 1885 (XIII. of 1885); or (2) a licence to import such apparatus has been granted by the Director-General of Posts and Telegraphs.—*Reuter's Trade Service* (Calcutta).

Norway.—Proposed New Cables.—On November 2nd *Tidens Tegn* published proposals said to have been submitted to the Norwegian Board of Telegraphs for two new cables for telephonic connection between Norway and Denmark and

Germany. The first proposal is for a cable, either from Arendal to Hirtshals, or from Fredriksvaern to Hirtshals, to cost about one and a half million kroner. The length of the cable would be 77½ or 88½ sea miles, according to the connecting points chosen, and would give three telephonic and one telegraph connections. The cable between Arendal and Germany would be laid over practically the same route as the existing telegraph line between Arendal and Sylt. The length of the cable would be 440 kilometres, and the total cost about five million kroner. By this cable three telephonic and one telegraphic connections could be made. In addition to the connection with Germany it would be possible to telephone to countries with which Germany is or may be connected, such as Holland, Belgium, France, Switzerland, Italy, &c. It is stated that a further proposal may be submitted to the Board of Telegraphs for a cable between West Norway (Stavanger) and England, calculated to cost about six or seven million kroner. The length of cable would be about 500 kilometres. The total cost of these lines would be about 14 million kroner, of which Norway would find seven millions, the assumption being that the remainder would be contributed by the other countries in the same manner as in the case of the existing telegraph cables, says the Department of Overseas Trade.

Russia.—Telegraphic Communication.—*Svensk Handelstidningen* learns that direct telegraphic communication will shortly be re-established between Sweden and Russia. The telegraphic station at Petrograd is now being reconstructed by the Store Nordiske Telegrafselska.—*Reuter's Trade Service* (Stockholm).

The Telephone Service.—Service Charges.—As a result of users of telephones being called upon to settle their accounts, based on the new scale of charges, indignant protests against the costliness of the service are a feature of the daily Press. According to *The Times*, in the case of large subscribers the expected has happened. In spite of their strenuous efforts to reduce the number of calls even below the level of efficiency, and far below that of convenience, the abolition of the flat rate, the new rentals, and the scales for trunk calls, have raised the cost of the service to a menacing height. The small subscriber is even more unfairly charged, as he is asked to pay sums which work out from 5d. to 1s. 5d. per call. So far most of the predictions made in the public protests against the new rates have proved correct.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—January 25th. Victorian Government Railways. Ten coasting recorders or, alternatively, 10 coasting and service recorders for the trains (cont. 34,736).

January 4th and 11th. Postmaster-General's Department. Telegraph instruments and telephone apparatus and material (Schedules 1,718 and 604). (November 18th.)

Belgium.—December 7th. Belgian State Railway. Supply of about 183 kilometres of electric cables, electric wire, and other miscellaneous material in connection with the railway electrification work. Particulars from the Office de l'Electricité des Chemins de Fer de l'Etat, Brussels.

Dublin.—December 12th. Dublin United Tramways Co. (1896), Ltd. General stores, including electric supplies, for six months. (November 25th.)

Egypt.—Alexandria.—December 21st. Port and Lighthouse Administration. Stores, including electric lamps, for six months.*

Farnworth.—December 7th. Urban District Council Electricity Department. L.p. cables, distribution pillars, transformer, h.p. and l.p. switches. (November 25th.)

France.—French Post and Telegraph Authorities in Paris. Supply of 22 kilometres of phosphor-bronze cable for the Croix-d'Hins wireless station.

Leeds.—Health Committee. December 10th. Installation of telephones at Old Killingbeck Sanatorium. Medical superintendent.

Liverpool.—December 28th. West Derby Board of Guardians. Engineering work, including electric power installation, electric lift, telephone installation, boilers, stokers, &c. (November 18th.)

London.—L.C.C. The Council is inviting applications by December 31st from firms, and particularly manufacturers, for permission to be placed on the lists of persons and firms from whom the Council from time to time invites tenders for the supply of fittings, electrical and mechanical equipment, and spares, &c., required for the Council's tramways. (See our advertisement pages to-day.)

H.M. Office of Works. December 14th. Electrical and mechanical engineering labour-in-daywork in connection with the maintenance, &c., of installations in the Glasgow and Edinburgh districts during a period of three years from January 1st, 1922. Contracts Branch, H.M. Office of Works, London, S.W.1.

Manchester.—December 9th. Electricity Committee. Heating plant and hot-water service apparatus for offices, and self-sustaining electric hoist, Barton power station. (November 18th.)

New Zealand.—Wellington.—March 6th. Public Works Tender Board. Waikato power scheme. Two 2,500-kVA alternators, two 3,100-h.p. water turbines, two exciter sets.*

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Australia.—Melbourne.—Morwell power scheme. Further to the note on p. 715 of our issue of November 25th, it is stated that Messrs. John Thompson, Ltd., secured, in the face of keen American competition, the contract for the supply of 12 water-tube boilers in connection with the electric power station at Morwell, Victoria. Each of the boilers, which are to have a working pressure of 200 lb. per sq. in., will evaporate 70,000 lb. of steam per hour, the steam being superheated to a temperature of 650 deg. F.; they are to be fired by underfeed forced draught travelling grate stokers, to burn the brown coal.

Belgium.—Thirteen firms submitted tenders to the Société du Canal et des Installations Maritimes de Bruxelles for the supply and installation at Wintham of an electric pump capable of delivering 150 cubic metres of water per hour. The lowest offer was that of Messrs. Desmedt, of Ixelles, who quoted 23,735 fr.

Glasgow.—Tramways Committee.

Motor for hoist.—Crompton & Co., Ltd.
Copper bonds.—British Insulated & Helsby Cables, Ltd.
Cable.—Siemens Bros. & Co., Ltd.

London.—St. Pancras.—Electricity and Public Lighting Committee. (Accepted):—

1,000 tons Bentinck Nutty slack, 27s. 4d. per ton; 500 tons Pinxton Low Main slack, 27s. 4d. per ton; 600 tons Ramscroft Hard Steam, 37s. 11d. per ton.—J. H. Beattie & Co., Ltd.
500 tons Bentinck Nutty slack, 23s. 10d. per ton plus 3s. 6d. per ton cartage.—A. Blackman & Co.
100 tons Russell's Black Vein Washed Nuts for special trial on No. 1 British Niclausse boiler, 41s. 8d. per ton, plus 3s. 6d. ton cartage.—Harper & Christopher.

(Recommended):—

Power rectifying plant, revised tender (£12,260).—Power Rectifiers, Ltd.

Singapore.—The Whessoe Foundry & Engineering Co., Ltd., have received from the Admiralty a contract for the supply and erection in Singapore of 10 steel oil fuel tanks, each 116 ft. diameter by 45 ft. 6 in. deep. They will be capable of holding about 12,000 tons of oil each.

FORTHCOMING EVENTS.

Batti-Wallahs.—Friday, December 2nd. At the Engineers' Club. At 7.45 p.m. Annual smoking concert.

Institute of Marine Engineers.—Friday, December 2nd. At the Hotel Cecil. Annual dinner.

Junior Institution of Engineers.—Friday, December 2nd. At Caxton Hall, S.W. At 8 p.m. Lecturette, "Notes on Maintenance of Electrical Accumulators," by Mr. B. L. Ladkin.

Friday, December 9th. At the Royal United Service Institution, Whitehall, S.W. At 7.30 p.m. Presidential address by Mr. C. H. Wordingham.

(Midland Section).—Tuesday, December 6th. At the Birmingham Chamber of Commerce, New Street, Birmingham. At 7 p.m. Presidential address by Mr. R. B. Askquith Ellis.

Northampton Polytechnic Institute, Clerkenwell.—Friday, December 2nd. At 7.30 p.m. Annual prize distribution (by Lord Southwark) and students' conversazione.

Salford Technical and Engineering Association.—Saturday, December 3rd. At the Royal Technical College. At 7 p.m. Annual meeting.

Institution of Electrical Engineers. Informal Meeting.—Monday, December 5th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Some recent developments in the design of a.c. instruments," to be opened by Mr. C. L. Lipman.

(Western Centre).—Monday, December 5th. At the Merchant Venturers' Technical College, Bristol. At 6.30 p.m. Paper on "Cye-Arc Process of Automatic Electric Welding," by Messrs. L. J. Steele and H. Martin.

(North-Western Students' Section).—Tuesday, December 6th. At the Houldsworth Hall, Deansgate, Manchester. At 7.30 p.m. Paper on "The Engineer and Manufacturing Costs," by Mr. F. C. Lawrence.

(London Students' Section).—Friday, December 9th. At the Ship Restaurant, 46, Charing Cross, S.W. At 7 p.m. Smoking concert.

(Wireless Section).—Wednesday, December 7th. At the Institution, Victoria Embankment. At 6 p.m. Paper on "An Investigation of Transmitting Aerial Resistances," by Mr. T. L. Eckersley.

(Irish Centre, Dublin).—Friday, December 9th. At the Royal College of Science, Dublin. At 8 p.m. Paper on "Electric Vehicles, their design, construction, and potentialities," by Mr. F. E. Walker.

Society of Engineers (Incorporated).—Monday, December 5th. At Burlington House, W. At 5.30 p.m. Paper on "Northwich Sewerage and Sewage Disposal Works," by Mr. W. M. Beckett.

Roentgen Society.—Tuesday, December 6th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 8.15 p.m. General meeting.

Institution of Railway Signal Engineers (Incorporated).—Wednesday, December 7th. At the Midland Grand Hotel, St. Pancras, N.W. At 6 p.m. Resumed discussion on "Three-position Signalling."

Paisley Association of Engineers.—Wednesday, December 7th. At the Y.M.C.A. Buildings, 23, High Street. At 7.30 p.m. Paper on "A Few Notes on the Manufacture of Electric Lamps," by Mr. P. McKenzie.

Northampton Engineering College Engineering Society.—Wednesday, December 7th. At the Institute, St. John Street, E.C. At 5.30 p.m. Paper on "Efficiency of Combustion," by Mr. V. R. Chadwick.

Chelmsford Engineering Society.—Thursday, December 8th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Hydro-electric Opportunities," by Mr. D. Spencer.

Chemical Society.—Thursday, December 8th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 8 p.m. Lecture by Prof. J. W. Gregory, F.R.S., on "The Genesis of Ores."

Edinburgh Electrical Society.—Friday, December 9th. At the Philosophical Institute. At 8 p.m. Paper on "A Chat on Wireless," by Mr. A. Whiteley.

Physical Society of London.—Friday, December 9th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary meeting.

Birmingham and District Electric Club.—Saturday, December 10th. At the Grand Hotel. At 7 p.m. Annual meeting.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

Queries addressed to the Electrical Review will be answered by post, if the desired information is available, provided the following simple rules are observed:—

1. Address your inquiries to the Electrical Review, Ltd., Service Department, *and enclose a stamped addressed envelope.*
2. Do not ask for information until you have satisfied yourself that it is not already contained in our advertisement pages.
3. If we are the means of putting you in touch with the firm or firms that you require, do us the favour of mentioning the Electrical Review.

No charge is made for the service.

Inquiries.—The attention of manufacturers and suppliers is specially directed to the fact that we have this week, amongst many other items, inquiries for:—

The "Safety First" bed warmer.

The "Semco" No. O Travelling Iron.

A four-pole switch bearing the trade mark "OFA" in a triangle surrounded by a circle.

A portable ammeter and voltmeter fitted with plugs and bayonet socket and suitable for reading both a.c. and d.c.

The "Tourtel" patent sealed locks.

The "Wizard" electric turbine and the "Wizard" dust extractor, Standard No. 2. Griffith's patent No. 11,837/09.

NOTES.

Association of Consulting Engineers.—The annual dinner of the Association of Consulting Engineers (Inc.) was held at the Engineers' Club, London, on November 4th, when Mr. W. Vaux-Graham, chairman of the Committee of the Association, presided over a gathering of some 95 members and guests; the function proved successful in every way. Following the loyal toast, that of "Princess Mary" was honoured, and a telegram of congratulation was dispatched. The "Association of Consulting Engineers" was proposed by the Rt. Hon. Lord Meston, K.C.S.I., and in his brief response the chairman paid a tribute to the work of the hon. officers of the Association, saying it was remarkable that the society did not employ a single paid officer. Mr. Sidney R. Lowcock, in a humorous speech, proposed the "Legal Profession" which toast was responded to by the Hon. Mr. Justice Shearman, and that of "Engineering Institutions," proposed by Mr. J. W. E. Binnie, was responded to by Sir Alex. B. W. Kennedy, LL.D., F.R.S., past president of the Institution C.E., and Mr. J. S. Highfield, president of the I.E.E. The former was understood to imply that if the Institution of Civil Engineers was not actually modifying its constitution, it was hoped that its council would at least adopt a more liberal policy in future. "British Industry" was propsed by Mr. A. H. Dykes, Hon. Sec. of the Association, and in responding therefor Sir Edward E. Pearson indicated his hopeful outlook of the future prospects. South America, he said, was crying out for British goods and manufacturers should never forget that it would be fatal to let them down; they must keep their promises with regard to delivery and maintain quality, workmanship, &c. He had confidence in labour; wages would fall, but would never reach the pre-war level, and every workman was worthy of his hire. If treated properly labour would be all right. The toast of "Our Guests" was proposed by Mr. G. Midgley Taylor; Sir John Snell, Chief Electricity Commissioner, and Sir William Noble, Chief Engineer to the Post Office, responded. Mr. G. M. Freeman, K.C., also spoke. Amongst those present were Sir Alfred T. Davies, K.B.E., C.B., Sir James Devonshire, K.B.E., Sir Harry Haward, the Hon. Mr. Justice McCardie, the Rt. Hon. C. A. McCurdy, P.C., K.C., M.P., Messrs. W. J. Jeeves, C.B.E., K.C., W. E. Tyldesley Jones, K.C., H. Booth, C.B.E., W. W. Lackie, C.B.E., A. Page, Mr. G. Scott Ram, Capt. H. F. J. Rowley, C.B.E., R.N., Eng. Lieut. W. T. Townend, R.N., Lt.-Col. H. G. K. Waite, C.B.E., D.S.O., R.E., Lt.-Col. C. E. Norton, C.M.G., R.E., and many others.

Midland Electrical Engineers' Ball.—This popular function, held on Friday evening, November 25th, at the Grand Hotel, Birmingham, was as usual extremely enjoyable by reason of the first-rate "staff-work" which had ensured an excellent band, good catering, and a splendid muster of dancing people. Mr. Chattock, as usual, was in excellent form, and the popularity of the well-known Birmingham chief was made evident by the fact that having made a short speech in one supper-room, he was forcibly compelled to repeat the process in the other. Altogether the evening reflected the greatest credit on the organisers.

Service Note.—The Admiralty, having come to the conclusion that the complicated character of electrical apparatus and torpedo equipment in the fleet warrants the division of the electrical artificer branch of the Navy into two sections, an Order in Council just issued has sanctioned the institution of the two branches, described in a schedule, with the pay and conditions of service of the existing electrical artificer branch, which they now supersede. The titles, under the new order, will be—electrical lieutenant and ordnance lieutenant (T); commissioned electrical officer, and commissioned ordnance officer (T); warrant electrical officer, and warrant ordnance officer (T); chief electrical artificer, chief torpedo artificer; and electrical artificer, and electrical torpedo artificer.

Appointments Vacant.—Consulting electrical engineer, for the Dun Laoghaire (Kingstown) Urban District Council; mains foreman (£5 15s.), for the City of Birmingham electric supply department. (See our advertisement pages to-day.)

The International Conference on Extra-High-Pressure Lines.—The International Conference on Extra-High-Pressure Transmission Lines, of which Mr. R. Borlase Matthews gives a preliminary account elsewhere in this issue, was organised by the Union des Syndicats de l'Electricité, the organising committee being under the chairmanship of its President, Mr. Raynald Legouez. The National branches of the International Electrotechnical Commission have collaborated in the conference, and have done much to assist in the success which has been achieved.

We understand from Mr. le Maistre, the General Secretary of the I.E.C., that in future close co-operation will be maintained with the Conference, which is to hold another meeting during the next year or two, and the organising committee and its very able secretary, M. Tribot Laspierre, have been invited to organise this next meeting.

The Conference unanimously agreed to recommend that its proceedings when published shall be transmitted to the National Committee of the I.E.C. for use in connection with the work of international standardisation, on which the latter is engaged.

Incidentally, we understand that the opportunity was taken for an exchange of views amongst those present who were particularly interested in the work of the I.E.C., and that important advances have been made towards a clearer understanding of the existing difficulties which hitherto have prevented the recommendations of the I.E.C. regarding industrial electrical machinery being completely accepted, and there is every hope that agreement amongst the various National Committees will not now be long delayed.

Educational.—At the annual distribution of prizes at the Aston (Birmingham) Technical School, on November 23rd, the Principal (Mr. C. A. White) said that nine firms in the district sent a number of youths, without loss of wages, to the school. These firms were well satisfied with the results, and reported increased efficiency. Prof. W. Cramp, of the University of Birmingham, presented the prizes, and said that he hoped more of the electrical firms of the district would follow the lead of those companies mentioned by the Principal.

Under the auspices of the Garden Cities and Town Planning Association, a series of lectures on "Garden Cities of the World," is being delivered at King's College, Strand, W.C. The third lecture of the series is to be given by Mr. Halsey Ricardo, F.R.I.B.A., on December 8th. His subject will be "Milan, and other Italian Cities."

Einstein and Ether.—The following letter appeared in *The Times* of November 26th: "To avoid the continuance of a mis-conception which has crept into the popular apprehension of Einstein's theory, I translate the conclusion and summing up of an address which Professor Einstein gave in May, 1920, to the University of Leiden:—

'According to the general theory of relativity, space is endowed with physical qualities; so in this sense an ether exists. Conformably with the general relativity theory, space without ether is unthinkable; for in such a space not only could there be no propagation of light, but also there would be no possibility of the existence of measuring rods and clocks, nor any space-time intervals in a physical sense. This ether, however, must not be thought of as endowed with the characteristic properties of ponderable matter . . . nor must the idea of motion be applied to it.'

With all this—I perhaps need hardly say—I heartily concur.

Yours faithfully,

Oliver Lodge."

King's College Engineering Society.—The 24th Annnal Dinner of this Society was held at the Holborn Restaurant on Friday last, and a happy and successful evening was spent by a record number of 160 past and present members who were able to attend. The chair was occupied by Mr. J. S. Highfield, president of the I.E.E., and a past member of the Society. The guest of the evening was Mr. W. B. Worthington, B.Sc., president of the Institution of Civil Engineers. The presence of the Principal of King's College, Dr. Barker, the Dean, Rev. Matthews, the Dean of the Faculty of Engineering, Prof. Wilson, and a muster of past and present members made the gathering a thoroughly representative one of the Society and its associations.

INSTITUTION NOTES.

The Institution of Electrical Engineers.—Informal Meetings.—At the meeting held on November 7th the chair was taken and a discussion opened by the president, Mr. J. S. Highfield, on "How best to speed up Electrical Progress." Mr. Highfield commenced by saying he would define electrical progress as "a condition where everybody who wants a job can get a job." To reach that happy state we must get our services appreciated and find out what was appreciated most. It was no good thinking of easy profits, it meant hard work and good service. As an example of how not to do it, he took the recent history of the coal trade. At the time of the Armistice the French and Italians were badly needing coal, and if the coal industry had put their backs into it we might now have had the goodwill of these nations. Instead, the situation was greedily exploited to the very utmost, with the result that the Frenchman, having got back his mines in Alsace, and the Italian counting up his water-power resources, resolved to avoid buying our coal at all costs, and the industry, instead of flourishing, was now in a state of lamentable depression. If the demand for electricity all over the country was in every way fostered by good service and honest efforts to cheapen supply there was a wave of prosperity just ahead. Bearing on the efforts to cheapen supply, the president gave some serious figures of the past and present labour output and the cost of materials. As it cost three to four times the old rates to connect a consumer, the small lighting service with low-current lamps might be years in proving a source of revenue to a system. He thought, therefore, that a customer should be induced to extend as far as possible the use of small apparatus, such as irons, toasters, &c., all of which might be served by the existing house wiring and a single meter, but charged for on the two-part tariff system. To this end it was very desirable that journeymen electricians and supervisors should be better trained in a knowledge of advocacy of electrical appliances. In the course of the discussion which followed, the I.E.E. wiring rules were criticised as unduly severe, and simpler methods were advocated. The vexatious regulations of supply authorities, which had no legal force, were also objected to, and Mr. Highfield in summing up dropped a hint that the wiring rules might be revised before long.

At the informal meeting on November 21st, Mr. J. F. Avila was in the chair during the discussion opened by Mr. A. J. Hainsworth on "Hydro-Electric Power." Mr. Hainsworth pointed out that it was essential that any power station should at the outset be designed for the ultimate capacity of the available water-power and so arranged that the full development might be carried out in stages. There was nothing to hinder this being done in water-power stations, as the total power available could be determined at the start. If it were decided to develop the station by stages as the demand for power increased, it would be good practice to commence laying out the general plans at the centre, and assume that the building would extend longitudinally in both directions. A station layout was often spoilt by having the switchboard placed across one end, so that as the station developed the distance between the switchboard operator and the floor engineer became greater as the units increased in number. Mr. Hainsworth described a typical station with a head of water on the turbines of approximately 170 feet. This station was designed for a maximum plant capacity of 144,000 h.p. in twelve 12,000-h.p., 11,000-volt, 3-phase, 50-cycle generating sets, with eight 15,000 kVA step-up, 11,000 to 110,000-volt transformer banks. He also described a transmission system projected by Mr. E. Parry for the New Zealand Government, for a network of 1,000 miles of 110,000-volt transmission lines in North Island, and an existing 66,000-volt system in South Island from Lake Coleridge which has been in service since 1914. A well-maintained discussion followed, of which perhaps the most striking feature was the ubiquity of the engineer. First-hand knowledge was contributed of water-power systems all over the globe.

Greenock Association of Electrical Engineers.—At a meeting held on November 23rd, Mr. G. M. S. Sichell, B.Sc., of Glasgow, gave an extremely interesting paper on "Electrical Troubles and their Location." Mr. Sichell laid stress on the advantage of possessing a fundamental knowledge of electro-mechanical science in the tracing of faults.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Col. O. C. Armstrong, D.S.O., who was last week elected president of the Federation of British Industries in succession to Sir Peter Rylands, is chairman of Messrs. Greenwood and Batley, Ltd., the well-known engineering and electrical manufacturing firm of Leeds. Previous to his taking up that appointment in 1914, he had been for five years managing director of Messrs. William Beardmore & Co., Ltd. A brief account of his career was given in the Electrical Review for October

Col. O. C. Armstrong, D.S.O.
The New President of the Federation of British Industries.

28th (p. 576). Col. Armstrong has been prominent in his association with engineering organisations, both in the mechanical engineering group of the F.B.I. and as chairman of the British Engineers' Association.

On Friday last, in the staff café at the Edison Swan Electric Co.'s Ponders End Works, there was a gathering of the staff to do honour to Mr. J. S. Child (joint sales manager), who is leaving the company after upwards of 30 years' service. A concert was organised by Mr. A. P. Ambler, and during the interval Mr. J. W. Elliott (lamp sales manager) presented a canteen of silver to Mr. Child on behalf of the staff. Mr. Elliott voiced the general regret of all that Mr. Child was leaving them, and referred to his splendid services rendered to the company. He also referred to Mr. Child's forthcoming marriage. Speeches in a similar strain were also made by Messrs. J. Bacon, T. S. Read, F. C. Raphael, W. C. Cooke, E. H. Miller, F. Evans, and A. P. Ambler. Mr. Child briefly responded.

On 22nd November Mr. J. M. Moffat was the recipient of a handsome solid silver cigar box and a cheque from the directors and staff of the Edison Swan Co. upon his completing 40 years' service. In making the presentation Mr. C. H. Cox, the commercial manager, spoke of Mr. Moffat's services to the company, and to the electrical industry in general, especially in its early days. Mr. R. H. Parker (the company's secretary), Mr. J. W. Elliott (lamp sales manager), and Mr. T. S. Read (assistant sales manager) also paid their tributes. Mr. Moffat, in responding, gave interesting reminiscences of the early days of the electrical trade.

At a farewell concert last week, Mr. J. W. Hame, late manager of the York Electricity and Tramways Department, was the recipient of a writing bureau from the staff and employés of the two departments. Mr. E. J. Nicholls presided over a large gathering, and the presentation was made by Mr. H. Chatto, the oldest employé in the electricity department.

Mr. G. W. Holmes, superintendent at the power station, expressed the hope that Mr. Hame would soon be strong and robust in health again. Mr. Hame, in thanking the staffs, paid a high tribute to the services rendered by Mr. Nicholls, Mr. Horton, and the other heads of departments.

On 24th November Mr. Frank A. Rawlings, of the Finance Branch of the Electricity Commission, was presented with a handsome canteen of cutlery by the Commissioners and their staff on the occasion of his marriage. Sir John Snell, chairman of the Commissioners, made the presentation in appreciative and felicitious terms, and conveyed to Mr. Rawlings the good wishes of his colleagues.

The distinction of Chevalier de la Légion d'Honneur has been conferred on M. Soubrier, professor of industrial electricity, and editor in chief of our Paris contemporary, *l'Electricien*, on the recommendation of the Minister of Public Instruction.

A Sheffield paper states that Mr. John Little, chief engineer of Messrs. Cammell, Laird & Co.'s works at Sheffield, &c., who was elected to the Southport Town Council in November, has been appointed vice-chairman of the Southport Electricity Committee.

A local paper reports that Mr. W. D. Brightman, secretary of the Bournemouth and Poole Electricity Supply Co., has been appointed to the dual office of manager and secretary of the company.

The works staff of Messrs. Babcock & Wilcox, Ltd., Renfrew and Dumbarton, marked with a gift of Treasury notes the retirement from active service of Mr. J. Wilkie, a member of the staff, after a continuous service of 31 years.

Obituary.—Ald. J. S. Hinchliffe.—We regret to announce the death, at the age of 57 years, of Alderman J. Stringer Hinchliffe, A.M.I.E.E., a member of the Leeds City Council and a partner in the firm of The Hinchliffe-Green Manufacturing Co., Ltd.

Mr. H. Wilson Fox.—We regret to state that Mr. H. Wilson Fox, M.P., editor of the *South African Mining Journal* in 1892, and appointed a director of the British South Africa Co. in 1913, died on November 22nd, in London, at the age of 58 years. He is described as the inventor of a system of hydraulic storage. His most important recent work has been in connection with the advocacy of Empire resources development as a means of making employment and relieving the burdens of taxation. He was a member of the Conjoint Board of Scientific Societies.

Mr. Hart, whose death we announced last week, was for many years associated with the firm of Peto & Radford, of London. He was 63 years of age.

NEW COMPANIES REGISTERED.

Wheeler's Electric Shade Carrier, Ltd. (177,916).—Private company. Registered November 19th. Capital, £10,000 in £1 shares. To take over from H. F. Wheeler the benefit of certain existing patents relating to improved means for securing shades to holders of electric lamps, and an improved metal-cutting tool, together with the business carried on by him in connection therewith. The subscribers (each with one share) are: H. F. Wheeler, 83a, Mosley Street, Manchester, mining engineer; T. Smith, 71, Princess Street, Manchester, solicitor. The first directors are to be appointed by the subscribers. Qualification: £100. Remuneration as fixed by the company. Solicitors: Slater, Heelis, Colley, Sandbach and Anderson, 71, Princess Street, Manchester.

G. Hands & Co. (Glasgow), Ltd. (11,939).—Private company. Registered in Edinburgh November 14th. Capital, £7,500 in 7,000 preference shares and 500 ordinary shares of £1 each. To acquire the business of George Hands & Co., and to carry on business as electrical, gas, hydraulic, sanitary, mining, mechanical, civil, and motor engineers, &c. The subscribers (each with 100 ordinary shares) are: G. Hands, 71, Farringdon Road, London, E.C.1, merchant; C. R. Arthur, 87, Dunlop Street, Glasgow. The first directors are: G. Hands and A. R. Arthur. Qualification, 50 ordinary shares. Registered office: 87, Dunlop Street, Glasgow.

Railgrip Syndicate, Ltd. (177,962).—Private company. Registered November 22nd. Capital, £10,000 in £1 shares. To acquire the world's rights in connection with an invention of a rail grip wheel, and to carry on the business of manufacturers of railway carriages and wagons, &c. The subscribers (each with one share) are: H. L. Bromhead, 10, Basinghall Street, E.C.2, accountant; W. A. Habberfield, 42, Criffel Avenue, Streatham Hill, S.W.2, accountant. The subscribers are to appoint the first directors. Remuneration, £100 each per annum (£150 for the chairman), free of income tax. Registered office, 10, Basinghall Street, E.C.2.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Henry Bisseker, Ltd.—Satisfaction on October 31st, 1921 (*a*) to the extent of £1,000 of first debentures, dated October 2nd, 1919, securing £7,700, and (*b*) to the extent of £1,000 of second debentures dated February 22nd, 1921, securing £8,300.

New Welding Co., Ltd.—Issue on November 4th of £100 and on November 9th, 1921, of £250 debentures, parts of a series already registered.

Ernest F. Moy, Ltd. (47,408).—Capital, £10,000 in 8,500 ordinary and 1,500 preference shares of £1 each. Return dated August 29th, 1921. All shares taken up. £10,000 paid. Mortgages and charges, £7,450.

Mersey Power Co., Ltd.—Trust deed dated October 31st, 1921, to secure £300,000 7½ per cent. mortgage debenture stock, charged on freehold and leasehold buildings, plant, machinery, and electrical undertakings and company's other assets, present and future, subject to prior charge. Trustees: Law Debenture Corporation.

Russells (Manchester), Ltd.—Second debenture dated November 7th, 1921, to secure £6,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. S. Berry, 60/62, Spring Gardens, Manchester.

Stanley J. Watson Magneto Co., Ltd.—Debenture dated October 31st, 1921, to secure £500, charged on the company's property, present and future, including uncalled capital. Holder: Mrs. E. F. Watson, 89, Queen's Road, Richmond, Surrey.

Bedale and District Electric Supply Co., Ltd.—Satisfaction in full on November 5th, 1921, of mortgage dated January 16th, 1920, securing £1,500 notified. Debenture dated November 7th, 1921, to secure £600 and mortgage of even date as further security for the said £600 and £1,500 secured by prior debenture, charged on the company's undertaking and property, present and future, including uncalled capital and land and premises in Bedale, Yorks. Holder: Sir William C. Gray, Bt., Thorpe Perrow, Yorks.

Adelaide Electric Supply Co., Ltd.—Acknowledgment of indebtedness dated November 14th, 1921, in the further sum of £350,000 under a trust deed dated June 11th, 1918, charged on such part of the company's undertaking in Adelaide as referred to in original deed. Holders: Electrical and General Investment Co.

A. and A. Electrical Co., Ltd.—Debenture dated November 15th, 1921, to secure all moneys due or to become due from the company to L.C.W. and Parr's Bank not exceeding £9,100, charged on the company's undertaking and property, present and future, including uncalled capital.

Kalgoorlie Electric Tramways, Ltd. (73,127).—Capital, £250,000 in £1 shares. Return dated August 11th, 1921. All shares taken up. £250,000 paid. Mortgages and charges, £143,820.

British Electric Traction Co., Ltd. (49,855).—Capital, £2,998,397 15s., of which to July 8th, 1921, £712,744 5s. had been issued in 6 per cent. cumulative participating preference stock and £1,326,263 10s. in ordinary stock. £2,039,007 15s. paid. Mortgages and charges, £1,733,133.

Royce, Ltd.—Capital, £170,000 in 70,000 preference and 100,000 ordinary shares of £1 each. Return dated August 11th 1921. 34,955 preference and 72,487 ordinary shares taken up. £1 per share called up on 4,955 preference and six ordinary, and 15s. per share on 30,000 preference. £27,461 paid. £79,981 considered as paid on 72,481 preference and 30,000 ordinary. Mortgages and charges, £44,394.

White, Jacoby & Co., Ltd.—Issue on October 18th, 1921, of £170 debentures, part of a series already registered.

Yorkshire Cable Co., Ltd.—Debentures dated October 12th, 1921, to secure £7,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Bank of Liverpool & Martins.

CITY NOTES.

The Eastern Telegraph Co., Ltd.

Sir J. Denison Pender presided on Tuesday at this company's meeting. He said that the gross revenue showed an increase of £322,798 over the previous year, which was their record year. On the other hand, the very large increase in working charges this year was relatively considerably greater, so that the net revenue for the year was £352,500 less than for 1919. In anticipation of a further increase in expenses they carried forward from 1919 £416,082, so that the available balance for the past year was £1,335,140. The principal increase in expenses was due to the revision of the standard scales of salaries and wages, and to the temporary allowances granted to the staff on account of the exceptional conditions of life which they in common with others working under similar conditions had experienced, both at home and abroad. There had been an increase of 318 in the number of the staff as compared with 1919, but they were only now beginning to overcome the shortness of staff from which they suffered during the war, and afterwards, when the growth of traffic increased in such a marked degree. The staff, though reduced in numbers, responded loyally to the expansion of the business, and willingly worked long hours in order to meet the demands of the Government and the public, but as that condition of affairs could not continue indefinitely, they had been making every effort to speed up the training, and the additional number which had passed through their college and been distributed over the various stations abroad was having the effect of reducing the amount of overtime and allowing the usual well-earned home leave. Fortunately their financial resources had enabled them to deal generously with their staff. It was also a source of satisfaction that they were able to justify an increase in the rate of dividend on the ordinary stock from 8 to 10 per cent. for the year 1919. When he last addressed them he stated that they were making every effort possible to re-establish the efficiency of the service, which had in common with other public services, been adversely affected during the war, when it was impossible to transmit commercial traffic without vary heavy delay owing to their inability to lay new cables or carry out the necessary constant renewals of their older sections. This drawback naturally prevented them from carrying satisfactorily the greatly increased volume of traffic with which they had to deal at that time, but he then informed them that an improvement had already taken place, and foreshadowed a still greater improvement when the whole work on hand was finished. That work was still proceeding, and as each section was completed the good effect was realised, and when the whole programme was finished they anticipated a cable service even more efficient and faster than that prior to 1914. The improvements would have entailed an expenditure by the company alone of about £3,750,000 sterling. So far, £1,300,000

had been charged against the general reserve fund, only £1,000,000 additional ordinary capital being raised. The traffic last year had been very variable, at which no one could wonder, but when business became more normal he hoped they might look for a traffic little short of that they had been carrying during the last two or three years, and if so they might find it advisable to still further increase their carrying capacity by laying additional cables in order to provide a larger margin of capacity in the possible event of an abnormal succession of temporary interruptions to their main line sections occurring, so that the traffic could be, even under those circumstances, carried without delay. They must be prepared to undertake that responsibility, therefore it was more than ever essential to carry substantial amounts to reserve fund whenever they were able to do so. The depreciation of the reserve fund investments had, at the date of the accounts, been fully provided for, and the sum of £2,215,000 odd at which they stood in the accounts represented approximately the actual value on December 31st last. Referring to the triple rate service, he said they would have welcomed its universal cancellation, but so long as foreign countries recognised this express system of communication at a charge of three times the ordinary rate, the merchant on British territory would be at a disadvantage if the same facilities were not accorded to him. Therefore the only way to modify the objections to this system which had been raised in certain quarters was for them to give such an efficient service at ordinary rates as would make the difference in the times of transit between the two services so small that it would not be worth the while of the merchant to pay for the use of a triple rate service, and it was that object the directors had always in view. Sir Albert J. Lepoc Cappe', K.C.I.E., seconded the motion, which was carried.

Telephone Manufacturing Co. (1920), Ltd.

The *Financial Times* states that the first report covering the period of nineteen months to May 31st, 1921, states that the company acquired the business of the Telephone Manufacturing Co. as from October 31st, 1919, and shares of eight installation companies in Great Britain as from December 31st, 1919. The profits totalled £45,831, plus dividends from installation companies, £52,173, making £98,004. There have been placed to investment reserve all profits accrued on installation companies to date as from which shares were purchased, £32,053; to general reserve, proportion of net manufacturing profits earned prior to date of incorporation, which the directors propose to utilise in writing down preliminary expenses, £12,454; leaving available £53,496. A dividend of 2s. per share, less tax, is proposed, carrying forward, subject to E.P.D. and Corporation Tax, £24,796. No figures are included in the above for five new British companies in Bristol, South Wales, Liverpool, Newcastle and Sheffield, the whole of the shares in which are held by the company. These companies have been in operation since about June, 1920, and it is estimated that considerable profits have already been made. The accounts of the companies abroad have not yet been completed, and nothing has been included in respect of their profits.

Barcelona Traction, Light & Power Co., Ltd.

A meeting of the holders of the 5½ per cent. first mortgage bonds of this company was held on Friday last, at Winchester House, E.C., for the purpose of considering and, if thought fit, passing, with or without modifications, a series of extraordinary resolutions.

Mr. Harold G. Brown, who presided, stated that he had been appointed by the National Trust Co., of Toronto, who were the trustees for the bond-holders of the Barcelona Traction Light & Power Co. The meeting had been convened by the company with the approval of the trustee company, and also with the approval of the Bond Holders' Committee. He requested Mr. Thomas Porter to act as secretary of the meeting, and asked Mr. Peacock, the chairman of the Bond Holders' Committee, to explain the proposals of the company.

Mr. E. R. Peacock said the report of the Bond-holders' Committee, of which those present had had copies, explained quite clearly what the proposals were, and he should therefore not go into the matter in great detail. The company was the holding company, dependent for its income on the revenue from the results derived by the Barcelona Traction, Light and Power Co., and that revenue was not good enough to allow them to pay 2 per cent. The outbreak of war threw everything into disorder, and to save their property, the bond-holders invented and worked out a plan by which the first mortgage bonds were put into the first place. In 1917 the construction of another large hydro-electric plant was begun, and in 1918 a new arrangement was entered into by which the company paid a minimum of 2 per cent. on the first mortgage bonds and a sum, if possible, up to 5 per cent. It was also agreed that the minimum should be raised to 4 per cent. The position justified them in taking an optimistic view of the situation because there seemed a prospect that the power produced by the two stations would be rapidly sold. They all knew, however, what had happened after the war. Spain had suffered with the rest, business had been dull, and the exchange had become unfavourable, with the result that they had not been able to raise the interest to 4 per cent., as it required £150,000 to pay the additional 3 per cent. The directors of the company came to the conclusion that the simplest method of dealing with the difficulty was to propose that the interest should not be less than 2 per cent., and that the maximum should be increased up to 6 per cent. It would be unwise to bind themselves as to when the interest must be raised. What they could say was, that the operating companies in Spain were in a position to take advantage of any improvement in business. They had a large reserve of power available for sale, but it was always necessary to spend money in an expanding business of this kind. He had a great faith in Barcelona as a field for electricity in the future. Next to Manchester it was a most important cotton manufacturing centre in Europe, and also had large woollen enterprises. The city continued to grow, and gave every indication of maintaining its claim as a most important industrial centre. The rates received for power now were much more in accord with the present day ideas of the value of power, and the company undoubtedly possessed the finest electrical plant in Spain. He moved the resolutions which were placed before the meeting. They had found no opposition to the proposals put forward in any quarters, and had received very substantial support.

The resolution having been seconded, Mr. Maxwell asked what the position of the ordinary stock of the company was, and whether the proposals contained in the resolution were made for the protection of the whole of the ordinary stock.

Mr. Peacock, in reply, said that Mr. Maxwell's question was one which had occurred to a good many people because the bond-holders seemed to be asked to make all the sacrifices in the organisation, and people wanted to know why the stockholders were not made to do something. It was what he had often thought himself, and it was an entirely safe inference to draw from what had happened, but it was not a correct one. To begin with, his conclusion had been that it had been impossible to get the stockholders to do anything that was worth while in an effective way for the company, and it would be foolish therefore to attempt it unless they were prepared to go to the length of buying them out. That involved a great many things, and it had always seemed to him to be better to try and carry on with the structure of the company as it was, rather than face a very complicated, and in some respects, dangerous result arising from the complete re-organisation of the company. The attempt to establish the company's credit in Spain, had been progressively successful, and they would probably cause more damage than good by a drastic re-organisation.

The chairman announced that the total amount of bonds represented at the meeting was £2,659,450, but the amount required for a quorum was over four millions, so that there was not a quorum present. That being so, he proposed, under the provisions of the Trust, to adjourn the meeting automatically until Thursday, the 29th December next, at the offices of the Canadian, General, & Finance Co., 3, London Wall Buildings, E.C., at 12.15 p.m., when the meeting would be purely formal, and the resolutions would be put to the meeting in any circumstances.

The meeting accordingly stood adjourned to the date mentioned.

Nairobi Electric Power and Lighting Co., Ltd.

The directors, in their statement just issued, say that in their last report it was indicated that early in 1920 the value of the local rupee was permanently fixed at 2s., and it was re-named the florin. In previous yearly accounts the local rupee was treated as the equivalent of 1s. 4d., and differences arising from its increasing value appeared in the revenue account as gain on exchange. In the accounts now submitted to the shareholders the florin is naturally translated at 2s., and there is no large gain on exchange as appearing in previous accounts. The result, however, of treating the local unit as having a value of 2s. instead of 1s. 4d. is an increase of approximately 50 per cent. in the items appearing on both sides of the revenue account, which must be borne in mind in attempting any comparison with the figures of previous years. The share capital remains at the same figure as before, but the outstanding debentures have been further reduced to £13,000. The repairs and maintenance account for the year is heavy, chiefly on account of repairs to the auxiliary steam plant, after the exceptionally heavy call upon its services in the recent years of water shortage. Dividends have been paid amounting to 10 per cent. for the year, less income tax, being at the same rate as in previous years. The units generated were:—

	1919.	1920.
By water power	1,096,670	1,472,804
By steam power	195,139	167,840
Total	1,291,809	1,640,644
Motors connected, b.h.p. ...	716	952
Lights connected, 40-W equiv. ...	15,752	17,173

Meeting: London, December 14th.

Victoria Falls & Transvaal Power Co., Ltd.—Net earnings, including those of the Rand Mines Power Supply Co., Ltd., for the quarter ended September, 1921, £205,885, before providing for taxation in South Africa and the United Kingdom.

Castner-Kellner Alkali Co., Ltd.—Dividend of 5 per cent., making 13 per cent. for the year.

Prospectus.—*Midland Counties Electric Supply Co., Ltd.*—This company, which recently changed its name from the Tramways Light & Power Co., has been offering for sale £400,000 seven and a half per cent. mortgage debenture stock at 96 per cent. The prospectus contains a statement signed by the chairman, Lord Chilston, in which the growth in the profits from 1915 to 1920 is tabulated. The net profits for 1920 (income tax paid) were £53,696, and after paying debenture and loan interest (£17,645), the surplus for dividends, reserve, &c., was £36,051. For 1921 the net receipts are estimated at £60,000 at least, and but for the coal strike effects they should have been £80,000. The proceeds of the issue will be utilised for the redemption of £200,000 8 per cent. Notes now outstanding, for discharging obligations to bankers, and for the general purposes of the company. The list is to be closed on or before December 5th.

Western Telegraph Co., Ltd.—The revenue for the year ended June 30th, 1921, was £2,073,498, and the working expenses were £1,024,425. Debenture-stock interest requires £32,747; Income Tax, E.P.D., and Corporation Profits Tax, £306,536; balance, £709,790, added to £149,410 brought forward, making £859,200. There has been transferred to general reserve £350,000, to the maintenance ships' reserve fund £50,000, and to land and buildings depreciation fund, £50,000. The distribution on the shares has been 10 per cent., free of income tax, for the year, and 4s. per share, free of income tax, on 96,102 new shares. There is a balance of £128,739 to carry forward. Annual meeting held on Wednesday.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—The report for the year ended December, 1920, which was submitted at the annual meeting on Wednesday, shows that the gross revenue was £2,514,825 less £744,934 working expenses, and £451,307 for maintenance of cables and special expenditure, leaving a balance of £1,318,584. After providing £666,138 for E.P.D., Corporation Tax, and Income Tax, payable in England, £30,096 for interest on mortgage debenture stock, and £5,451 on account of expenses of issue of new capital, there is a balance of £616,898 plus £232,440 brought forward, making £849,338, of which £450,000 has been put to general reserve. After paying dividends of 10 per cent. free of income tax, and a dividend of 4s. per share free of tax on the new shares, there is a balance of £80,779 to carry forward.

A Swedish Company.—The accounts of the Elektriska Aktiebolag Chr. Bergh & Co., which has a share capital of 5,089,000 kr., show a loss of 3,202,000 kr. for 1920-21 as contrasted with a loss of 1,131,000 kr. in the previous year. The loss is attributed to the holding of extensive stocks, doubtful claims arising from the preceding year, and the unfavourable situation of trade in conjunction with German competition. Having regard to the uncertainty of the general economic situation, the directors are unable at present to put forward any proposal for covering the loss, but will submit a scheme of reconstruction as soon as prospects exist for the consolidation of the position. Apparently manufacturing was suspended during the year, as the receipts are reported at merely 26,000 kr., most of which were rents.

Cape Electric Tramways, Ltd.—For the year ended June 30th there was a profit of £81,724. After providing for debenture interest, redemption of debentures, and including the balance brought forward, the net credit balance is £60,046. The reserve fund has been credited with £18,000, leaving £42,046. A dividend of 6 per cent. on the ordinary is to be paid, leaving £12,573 to be carried forward. After protracted negotiations, the Municipality of Cape Town came to a decision not to proceed with its proposal for acquisition of this company's Cape Town system. The concession will, therefore, run on until 1925, when the question may again arise.

Greenock and Port Glasgow Tramways Co., Ltd.—The total receipts for 1920 were £84,518. After providing for all expenses, including mortgage interest, amounts payable under agreements, and setting aside £6,000 for renewals, there was a surplus of £3,937, plus £216 brought forward. The directors propose placing to sinking fund for loan redemption £1,743, to reserve £2,000, leaving to be carried forward £410. The result does not admit of payment of any dividend.—*Financial Times.*

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a :—

British Thomson-Houston Co.—£1,500,000 seven per cent. mortgage debenture stock, issued at 92½ per cent., partly paid (and fully paid on December 1st), after issue of allotment letters.

Low Temperature Carbonisation.—40,928 ordinary shares of £1 each, fully paid, Nos. 200,001 to 240,928.

British Vacuum Cleaner Co., Ltd.—After writing off depreciation of plant, premises, &c., £1,351, there is a balance of net profit of £1,008 plus £582 brought forward. There has been placed to reserve £1,000, leaving to be carried forward £590.

Tube Investments, Ltd.—After paying the final dividend on the 7 per cent. preference shares, a dividend has been declared on the ordinary shares for the year ended in October at the rate of 8 per cent., less tax.

Montreal Water & Power Co.—Dividend of 3½ per cent. for the half-year ended October on preferred and common stocks.

Canadian General Electric Co., Ltd.—Quarterly dividend of 2 per cent. on common stock, for three months ending December, 1921.

Globe Telegraph & Trust Co., Ltd.—Quarterly dividend of 3s. per share less tax on the preference, and 5s. per share net on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

The financial outlook continues to be not unlike that which characterised the weather in the early part of the week: foggy, that is to say; rendering it difficult to "see one's way," as the Stock Exchange says. There is nothing very fresh in the situation, Ireland and the foreign exchanges being the chief niggers in the hedge, while cheerful talk of improvements in various trade conditions have been a little tempered by the inevitable disappointments and setbacks that occurred, even in such industries as those which are undoubtedly working towards brighter days. Investment money is clamantly required, by borrowers who offer gilt-edged stocks which are taken with a little less readiness than prevailed at the beginning of the month by the real investor.

Having regard to the striking success of its new issue of £1,500,000 7 per cent. mortgage debenture stock offered at 92½ by the British Thomson-Houston Co., it was expected that there might be a premium of 2 or 3 points on the stock when the market began, but the opening price led off at ¾ discount. Next day, it hardened to ¼ premium. How the company will fare in the future is a matter likely to engage no little attention from those who are interested in electrical and engineering concerns, for, as was mentioned last week, the company did not pay the dividends on its preference shares from 1906 to 1920 inclusive, although the whole lot of arrears was cleared off in July last year. The ordinary shares also received 10 per cent. at that time, after going without a return for seventeen years.

An issue of ten million dollars Pacific, Gas & Electric Co. 1st mortgage 6 per cent. bonds, 1941, at 98½ has just been made. The investment will probably appeal more to capitalists in the United States than to those on this side. The Midland Electric Corporation has been offering £400,000 7½ per cent. mortgage debenture stock at 96. Prompt subscription led to the list being closed six days in advance of the full time indicated by the prospectus. An issue of £300,000 Telephone Manufacturing Co. 8 per cent. cumulative income bonds, at 96 is expected. Some of the cable companies' reports for last year are now available, and make an interesting showing. The Western gross revenue was just over two million pounds, a decline of £600,000, while the working expenses of a little over a million sterling showed an increase of £85,000. The company's bill for taxes, however, at £306,000 is less than half that of the preceding year and the dividend is maintained, as already announced, at 10 per cent. free of tax, the company carrying forward a smaller balance to the new year. The Eastern Telegraph Co. has done better. The gross revenue of £4,400,000 is £320,000 up, as compared with the previous year. The expenses, however, advanced by half-a-million sterling, owing mainly to an advance in salaries and wages. On balance, the net revenue fell off by £352,000, but owing to the large amount brought forward, the company not only maintained its usual 10 per cent. free-of-tax dividend, but placed half-a-million to general reserve and carried forward £316,000, which is about £100,000 less than that similarly dealt with in 1920.

The Eastern Extension results are handicapped by the taxes of £666,000, being £250,000 larger than those for the previous year. The depreciation-of-investments account gets nothing this year, as against £200,000 a year ago, and the company carries forward the small amount of £80,000. The results are good enough, considering the times through which industry is passing, and cable stocks are amongst the very few which have shown hardly any depreciation during the trade slump throughout the world.

Marconis have gone back to 1¼, and the wireless group is very quiet.

Kensington ordinary, amongst electric lighting shares, have gained another 2s. 6d. at 4¼. County of London at 8 13/16 are better, but there are shares on offer at this price. Notting Hill preference have risen to 7¼, a gain of 5s. Manufacturing issues are inclined to be dull. General Electrics eased off to 17s., English Electrics gave way to 8s. 9d. and Edison 1st debenture at 64 is a point down. Stock changed hands at 63. India Rubbers, following upon the report of last week, shed another 1/16 to 11s. 3d., though there have been a good many buying orders in the market on the basis of 10s. to 11s. Evidently, people recognise that the company has an ex-

cellent business, and it is only a matter of time before the melancholy loss, just reported, has been wiped out and the company sets out in the direction of prosperity once more. Babcock & Wilcox at 2¾ are 1/16 higher.

Metropolitan Consolidated, at 24, has a rise of 10s., and is the only stock in the Underground group to exhibit any trace of vitality. The market is somewhat disturbed by the restive condition of the London General Omnibus men, who, although they have decided against a strike, seem to be far from satisfied with the new arrangements which the company is about to introduce in order to meet the decrease in fares that takes place this week. Home Railway dividend estimates in respect of this year are anything but exhilarating, although the underground is expected to suffer less than the steam railway companies.

Mexican Utility bonds are better. The American buying of the past few days has spread beyond Mexican Government bonds, and has included within its scope Mexican Light and Power, Mexico Tramways, and Mexican Electric Light issues. Those who are in touch with Mexican conditions aver that President Obregon is faced with conditions more difficult than most people realise, owing to the fact that corruption is declared to be rife in his country, in consequence of which a considerable proportion of revenue fails to reach the people for whom it is intended. Once the Mexican can be educated to take a more serious view of responsibility, it is held that commerce and industry will go ahead freely, and, in anticipation of this, the speculative investor is laying in a few stocks and bonds of the utility companies.

Rubber shares remain firm, with a moderate amount of business going on in them. The produce keeps about a penny or so under 1s. per lb. Armaments and kindred descriptions continue under the chastening influence of the proposals propounded at the Washington Conference.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1919.	Dividend. 1920.	Price Nov. 29, 1921.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	6⅝	—	£9 18 0
Charing Cross Ordinary	7	8	4½	—	8 17 10
do. do. do. 4½ Pref.	4½	4½	3½	—	7 4 4
Chelsea	4	6	3½	—	9 4 8
City of London	13	14	26·9	—	10 9 6
do. do. 6 per cent. Pref.	6	6	17/6	—	6 17 2
County of London	8	8	8⅛	+ ⅛	9 1 6
do. do. 5 per cent. Pref.	6	6	7⅝	—	7 10 0
Kensington Ordinary	7	9	4¼	+ ¼	9 4 8
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	3	—	10 0 0
Metropolitan	6	7	8⅞	—	9 6 8
do. 4½ per cent. Pref.	4½	4½	2⅛	—	7 18 2
St. James' and Pall Mall	12	12	6½	—	8 17 10
South London	6	7	2⅝	—	10 18 2
South Metropolitan Pref.	7	7	16/3	—	8 12 4
Westminster Ordinary	10	10	5½	—	8 13 10
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	82½	—	7 5 7
do. Def.	1½	1½	17	—	8 16 6
Chile Telephone	6	6	5½	—	5 17 3
Cuba Sub. Ord.	7	7	7	—	10 0 0
Eastern Extension	10	10	16⅝	—	6 2 2
Eastern Tel Ord.	10	10	16½	—1	6 3 1
Globe Tel. and T. Ord.	10	10	16⅝	—	6 2 2
do. do. Pref.	6	6	9½	—	6 9 9
Great Northern Tel.	22	24	25	—	9 12 0
Indo-European	10	10	30	—	8 6 8
Marconi	25	15	1½	— ⅛	10 0 0
Oriental Telephone Ord.	12	12	2	—	*6 0 0
United R. Plate Tel.	8	8	5⅛	—	*7 0 8
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	16⅝	— ⅛	*6 2 2
Home Rails.					
Central London Ord. Assented	4	4	49½	—	8 1 8
Metropolitan	1½	1½	24	+ ½	6 5 0
do. District	Nil	Nil	16	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅜	—	Nil
do. do. "A"	Nil	Nil	5/-	—	Nil
do. do. Income	4	2	65½	—	*4 13 0
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	93	—	10 9 6
do. do. 2nd Pref.	Nil	5½	21½	—	10 4 8
do. do. 5 per cent. Deb.	5	5	65	+ ½	7 18 10
Brazil Tractions	Nil	Nil	29	—1	Nil
British Columbia Elec. Rly. Pfce.	5	5	58	—	8 12 4
do. do. Preferred	5	93/-	51	—	*9 5 0
do. do. Deferred	3	124/-	56½	+3½	*10 19 6
do. do. Deb.	4½	4½	60	+1½	7 1 8
Mexico Trams. 5 per cent. Bonds	Nil	Nil	58½	+1½	—
do. do. 6 per cent. Bonds	Nil	Nil	27½	+1½	Nil
Mexican Light Common	Nil	Nil	10	—	Nil
do. Pref.	Nil	Nil	35	—	Nil
do. 1st Bonds	Nil	5	57½	+4	8 13 10
Manufacturing Companies.					
Babcock & Wilcox	15	16	2¾	+1/16	6 14 9
British Aluminium Ord.	10	10	14/6	—	—
British Insulated Ord.	15	15	1½	—	10 0 0
Callenders	15	15	1⅝	—	10 18 2
,, 6½ Pref.	6½	6½	18/9	—	6 18 8
Crompton Ord.	10	10	14/6	—	13 15 10
Edison-Swan	10	—	5/8	—	—
do. do. 5 per cent. Deb.	5	5	64	—1	7 16 3
Electric Construction	10	10	17/6	—	11 8 6
English Electric	8	8	8/9	—1/8	18 5 8
do. Pref.	6	6	13/9	—	8 14 6
Gen. Elec. Pref.	6½	6½	17/-	—	7 13 0
do. Ord.	10	10	17/-	—6d.	11 15 4
Henley	15	15	1½	—	10 0 0
do. 4½ Pref.	4½	4½	3½	—	6 8 8
India-Rubber	10	—	⅞	—	—
Met.-Vickers Pref.	8	8	1½	—	8 16 8
Siemens Ord.	10	10	1⅞	—	*9 8 2
Telegraph Con.	20	20	21½	—	*5 11 9

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 30th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	9d.	..
a Ammoniac Sal per ton	£65	..
a Ammonia, Muriate (large crystal) ,,	£58	..
a Bisulphide of Carbon ,,	..	..
c Borax ,,	£31	..
a Copper Sulphate ,,	£30	..
a Potash, Chlorate per lb.	6½d.	..
a ,, Perchlorate ,,	5d.	..
a Shellac per cwt	£17 10s.	..
a Sulphur, Sublimed Flowers ,,	£15	..
a ,, Lump ,,	£14	..
a Soda, Chlorate per lb.	3½d.	..
a ,, Crystals per ton	£7	..
a Sodium Bichromate, casks per lb.	6½d.	..
METALS, &c.		
p Babbitt's Metal and Anti-friction Metal—		
Grade I per ton net	£160	..
Grade II ,, ,,	£118	..
Grade III ,, ,,	£71	..
c Brass (rolled metal 9" to 12" basis) per lb.	10½d.	..
c ,, Tubes (solid drawn) ,,	1/0½ to 1/0½	..
c ,, Wire, basis ,,	11½d.	..
c Copper Tubes (solid drawn) ,,	1/0½	..
c ,, Bars (best selected) per ton	£101	..
c ,, Sheet ,,	£101	..
c ,, Rod ,,	£101	..
d ,, (Electrolytic) Bars ,,	£76 15s.	5/- inc.
d ,, ,, Sheets ,,	£145 10s.	..
d ,, ,, Wire Rods ,,	£93 15s.	5/- inc.
d ,, ,, H.C. Wire per lb.	11 7/8d.	⅛d. inc.
f Ebonite Rod ,,	2/6	..
f ,, Sheet ,,	3/-	..
g German Silver Wire ,,	2/9	..
h Gutta-percha, fine ,,	12/6	..
h India-rubber, Para fine ,,	1/9½	½d. inc.
i Iron Pig (Cleveland Warrants) per ton	Nom.	..
i ,, Wire, galv. No. 8, P.O. qual. ,,	£29	..
g Lead, English Pig ,,	£27	35/- inc.
g Mercury per bot.	£10 5s. to £10 10s.	10/- to 15/- inc.
e Mica (in original cases) small per lb.	3d. to 3/-	..
e ,, ,, ,, medium ,,	4/- to 8/-	..
e ,, ,, ,, large ,,	10/- to 20/- & up	..
p Phosphor Bronze, plain castings ,,	1/3	..
p ,, ,, drawn bars and rods ,,	1/4½	..
p ,, ,, rolled strip & sheet ,,	1/4½	..
p ,, ,, Wire ,,	1/5½	..
d Silicium Bronze Wire per lb.	1/2½	½d. dec.
r Steel, Magnet, in bars ,,	1/5	..
n Tin, Block (English) per ton	£161 10s.	£4 10s. to £5 in
n ,, Wire, Nos. 1 to 16 per lb.	3/6	..
p White Anti-friction Metals per ton	£65 to £375	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormsion & Sons.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Electric Motor Vans in Sweden.—The Swedish State Railway authorities recently asked the Government for permission to purchase from abroad electric motor vans for the transport of travellers' luggage. Objections to the placing of the order outside the country were raised by the A. B. Svea, and to these the State Railway authorities have now issued a reply. They state that they were not aware that the A. B. Svea produced vans such as were proposed to be acquired, but in the middle of October the former asked the latter to submit a tender for the supply of such vehicles. No reply, however, has yet been received. The railway authorities state that they have learned privately that the A. B. Svea was endeavouring to get an offer from America. As the firm were unable to present the particulars asked for, the railway authorities recommend that no action should be taken with regard to the firm's objections.

Water Power in Scotland.—Reporting to the Edinburgh Chamber of Commerce on the British Association meetings, and particularly with regard to theu se of water power in Scotland, Mr. I. Cockburn Miller said the Water Power Resources Committee of the Board of Trade had strongly recommended that additional facilities should be provided in technical colleges and universities for the study of hydro-electric development, and as the result of the Committee's representations it had been decided to initiate a chair of hydro-electric engineering in some chosen university. Edinburgh was the most favourable place for this, and he suggested that they should select a committee of engineers to promote the idea. It was agreed that the directors should take the matter into consideration.

Rayleigh Memorial.—The memorial tablet to the late Lord Rayleigh, executed by Mr. Derwent Wood, R.A., was unveiled in the North Transept of Westminster Abbey on Wednesday last, the anniversary day of the Royal Society.

EXPERT EVIDENCE.

[By A Legal Contributor.]

In a recent case before the House of Lords (Attorney-General *v.* Cory Brothers) their lordships had something to say about the evidence of expert witnesses. It was necessary to determine what caused a colliery dump or slag heap to slide down into a valley and cause damage to the property of the plaintiffs. Much depended upon the evidence of certain eminent engineers and geologists who were called as witnesses on either side.

Lord Haldane, having discussed the various theories put forward, said, in the course of his judgment: "The conclusion to which I have come is one which is consistent with the scientific evidence, and it appears to me to be the only one which is borne out by the chronology of what was observed." Lord Atkinson said—referring to the evidence of one witness: "However eminent an expert may be, he cannot make an effect precede its cause," while Lord Shaw, commenting upon the somewhat involved testimony of another witness, said: "If the theory of this learned man be sound, it is extremely difficult to see why what happened could ever have happened."

It might be inferred from these expressions of opinion that judges are apt to speak contemptuously of scientific evidence; but this is not so. For one expert whose evidence is ignored, there are ten whose testimony is received and acted upon by the tribunal before which they have been summoned as witnesses. Without them, it had been impossible in many cases to do justice between the parties.

The truth is, of course, that although they may not often admit the fact in public, those who preside over our judicial tribunals cannot get on without the expert witness. He is not necessarily a scientific man, yet, in point of fact, expert testimony is mainly required in cases of a technical character, which may be of infinite complexity. There is no scientific matter which may not have to be discussed in courts of justice. One recalls the case in which a secret chemical process used in photography formed the subject of an action. Counsel for the plaintiff asked that the general public might be excluded from the court, or the process might be revealed. "Yes," said the judge, not appreciating perhaps that his words might have a double meaning, "the case ought certainly to be tried *in camera*."

The evidence of a scientific man is only "expert" when it involves a question of *opinion;* otherwise he is a mere witness to facts. Suppose, for example, he is describing the result of experiments conducted by himself, he gives an answer to a question of fact. If, however, he is asked what would be the chemical effect of mixing substance A with substance B, his answer is that of an expert witness.

The importance of expert evidence varies according to the tribunal before which it is adduced. For example: An "ordinary" (using the word in no invidious sense) judge will probably not be familiar with electricity in all its many applications to the needs of mankind. He may not even understand any of the terms which run so easily off the tongue of an electrical engineer. Once in half a century, perhaps, we have a judge like the late Lord Moulton who was a veritable encyclopædia of scientific knowledge; but his was an intellect of the rarest. It may be assumed that in every technical case the judge will welcome the expert witness if only to enable him to understand the nature of the question which it is his duty to determine. But there are some tribunals before which it were superfluous to call experts. Thus the Electricity Commissioners require no guidance on technical points, at any rate, from electrical engineers. Indeed, nothing was more remarkable in the recent inquiry conducted by these gentlemen at the Institution of Electrical Engineers than the way in which counsel appearing for the various parties were left far behind by the members of the tribunal when "the technical question" was before the court.

Between the two extremes above mentioned there is every variety of tribunal which may or may not require the assistance of the expert. That judges require technical aid from someone has been recognised more than once by the legislature. The Admiralty Court sits with nautical assessors; all judges have power to summon assessors if so minded, while judges of county courts frequently sit with medical assessors when deciding Workmen's Compensation cases.

One difficulty which besets the scientific man summoned as a witness is that he does not know what degree of ignorance or knowledge he is to attribute to the court. If he assumes that the judge knows nothing, say, of electricity, and begins at the beginning, he may be hauled up for wasting the time of the Court. If he assumes the judge knows all about the subject, he may again be accused of wasting the time of the Court in talking of things which no one present understands but himself. As a general rule, the legal adviser of the party on whose behalf the witness has been summoned, will be able to tell him something as to the extent of the judge's scientific knowledge. But even he may not be able to do this; and some of our judges have the two faculties of concealing their ignorance and of acquiring knowledge developed in a very marked degree.

The writer recalls an observation made to him by one of the experts who gave evidence in the celebrated Marconi case which was tried some years ago by Lord Parker, when he was a judge of the Chancery Division. On being asked whether the judge was able to understand the evidence, he said: "When I left the Court, after hearing the judgment, I was convinced that there was no expert who had a better knowledge of the scientific points discussed than Mr. Justice Parker!" This is the more remarkable when it is mentioned that the learned judge was a classical scholar who had never had any scientific training in his youth.

One of the principal functions of the expert witness falls to be discharged before he goes into Court at all. He has to coach learned counsel in the scientific aspects of the case. Some members of the Bar who make a speciality of technical cases will require little teaching; but there are others who are prone to get lost among technical terms and phrases unless their meaning is explained. To give that explanation is the duty of the expert in consultation. He will generally find his pupils very apt to imbibe instruction. He ought to tell them enough to enable them to expound first principles to the judge. There is one rule which the expert should keep firmly in mind when he gets into Court: he must never act, or even appear to act, as advocate for the party who has called him as a witness. If the judge once gets the idea that a witness is advocating the cause, he is more than likely to discount the whole of his evidence.

Nor should the expert be over-confident. Modesty is at all times becoming. The story is told of a witness who was asked whether Mr. A. B. was not the most eminent engineer in London?

"No," said the witness.

Upon this the judge intervened: "Would you mind telling me *who* is the most eminent engineer in London?"

"I am, my Lord," was the reply.

To someone who subsequently criticised his conduct, he explained that, as he was on oath in the witness-box, he had felt bound to speak the truth!

REFRIGERATING PLANT.

Few loads appeal so directly to the electricity supply engineer as an ice-making plant, for this is an industry which is at its fullest activity in the summer and at its minimum in the winter. Moreover, a considerable amount of power is required, as will be gathered from the following particulars of a large ice factory in a North-East Coast town.

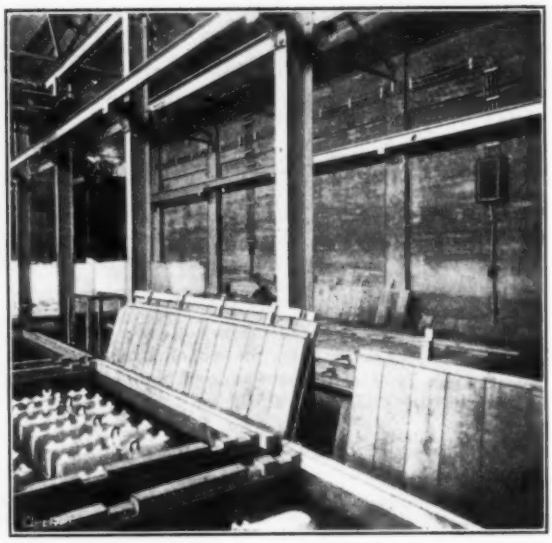

Fig. 1.—Ice-making Tanks.

Power is derived from the Corporation mains at 6,600 volts, 3-phase, 50 cycles, and is transformed on the premises to 440 volts. The refrigerating apparatus work on the direct-expansion principle, and were installed by the Pluperfect Refrigerating Co., of Manchester, the compressors being made by The Lightfoot Refrigerator Co., Ltd., London; each of the main compressors is belt driven by a 250-h.p. motor, the actual power required averaging about 200 h.p. When the plant is working at full capacity, the aggregate load averages about 520 h.p., including the power required by the auxiliary compressors, circulating pumps, crushing machinery, &c.

Fig. 1 shows part of the freezing apparatus and the open wiring on the wall, while fig. 2 shows the main switchboard and some of the smaller motor-driven machines, with a snow-clad pipe connected with a refrigerating machine. Here again the wiring forms a noteworthy feature, consisting not of lead-covered cable as might be supposed, but of "C.T.S." cable, supplied by the St. Helens Cable and Rubber Co., Ltd., of Warrington. The use of this class of cable was due to the experience gained in similar circumstances by the Park Electrical and Engineering Co., of Manchester, which specialises in this class of work, and which designed and carried out the whole of the electrical installation. The conditions of extreme cold which are met with in ice-making installations are very severe in their effects upon cables and wiring, but the Park Electrical and Engineering Co., having used St. Helens C.T.S. cable with satisfactory results in other installations where varying temperatures and severe conditions were encountered, carried out the whole of the wiring with this material, without any further protection than its own sheathing.

Between the transformer and the main switchboard there is a run of about 150 ft. of two cables in parallel, each of which consists of three cores of 0.5 sq. in., and one core of 0.25 sq. in.; these are believed to be amongst the largest C.T.S. cables of this description manufactured up to the present, being $3\frac{1}{4}$ inches in diameter overall.

The lighting installation comprises some 150 points, split between the three phases and the neutral through three single-pole switches and fuses on the main board, and controlled by acid-proof switches provided in the various departments. As shown in the illustrations, the wiring is carried on cleats throughout the installation.

The switchboard is equipped with one 900-ampere main oil switch, and five circuit oil switches which control the circuits running to the various motors.

A few words regarding the process employed may be of interest. No brine is used in this system, anhydrous ammonia being itself the cooling agent. The compressors bring the gaseous ammonia up to a pressure of 140 or 160 lb. per sq. in. At this pressure the gas passes to a condenser in which it is liquefied, the latent heat being removed. The liquid ammonia is then allowed to flow through the expansion coils of the ice-making tanks, where it absorbs heat from the water and again reaches the gaseous state. This gas is again taken in by the compressor and the cycle is repeated. One advantage which this system possesses over the ordinary brine process is the speed with which the ice blocks can be released and removed. This is effected by reversing the direction of the liquid ammonia through the freezing pipes of the tank, which quickly causes a movement of the pipes away from the ice.

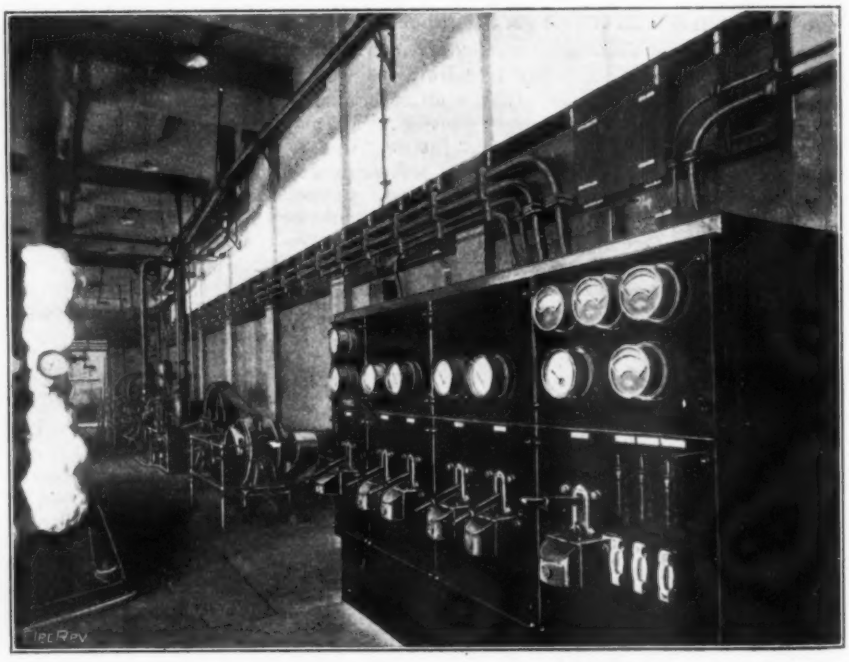

Fig. 2.—Main Switchboard and Heavy C.T.S. Cables.

THE FEDERATION OF BRITISH INDUSTRIES.

The Annual Meeting.

The annual general meeting of the Federation of British Industries was held at the Hotel Cecil on Wednesday, November 23rd.

Sir W. Peter Rylands, the retiring president, surveying the work of the Federation during the past year, said he was convinced that the present world-wide prestige of the Federation was attributable to the policy which it had consistently pursued. It had not aimed to achieve its ends by wielding the big stick. They claimed that industry, and consequent employment, was the first interest of the State. They claimed that manufacturers had the greatest practical experience on this subject, and that their views were therefore entitled to serious consideration, if expressed with reason, moderation, and with due regard to the general interests of the community. They could not, however, expect to have it all their own way. Sometimes they might not be right. At others their views might be over-ridden by political considerations, and they might be able to indulge in the cold comfort of being able to say: "We told you so," when the wisdom of their view was proved by the event, and the adoption of a contrary policy attended with misfortune, possibly disaster. Such a case he believed to be presented by the unfortunate financial policy of the Government. The Federation addressed a serious warning to the Chancellor of the Exchequer 18 months ago, when he proposed to increase the rate of E.P.D., and also to institute a new burden upon industry in the form of the Corporation Tax. They were confident that both steps were unwise. He was disposed at the time to think that the Chancellor was inclined to waver on the point, but political considerations were irresistible. No doubt at that time industry had been enjoying a period of remarkable prosperity, and the official mind was disposed to attribute the views of the Federation to unwarranted pessimism. It might be an exaggeration to attribute the nation's troubles to the heavy burden then laid upon industry, but he had no hesitation in saying that the result had been to increase those troubles and to aggravate most seriously the difficulties which would come before the nation in the immediate future. The Government had squeezed industry financially dry, and by the operation of the income tax based on three years' average profits, many companies would be hard pressed to meet their commitments during the next few years, except by inroads into their capital. Nothing could be more calculated to hamper demand and depress trade. The outlook was serious, and in the absence of world-wide trade revival, of which at the present time there appeared but small prospect, the Chancellor of the Exchequer would be well advised to retrace his unfortunate step, as far as possible, and to lighten the burden upon industry at all costs. Taxation must be paid out of production, and with the nation's productions far below the normal level, the taxable capacity of the nation was more than proportionately reduced. Industry was the engine which drove the ship of State, and they could liken it to an internal-combustion engine in that any serious overload was followed by an actual reduction in power. It was no use trying to carry a burden heavier than could be borne. The result must be a reduction in production, and so make the burden even more intolerable. It was wiser to recognise that the country was passing through a period of extraordinary difficulty, and believing it to be temporary only, the safety of the ship of industry was of far greater moment than to carry the cargo into port. These views were widely held by manufacturers who realised better than any the difficulties with which they had to contend in maintaining their output, and they agreed that even at the risk of the charge of being actuated by selfish motives, the Federation should press on the Government the wisdom of pursuing a financial policy which, even if for the moment economically unsound, was in the true national interest and a practical expedient. They should be no less insistent on the need for drastic economy in the Government service. He appreciated the action of the Chancellor of the Exchequer in affording them opportunities of conferring with the officials at Somerset House on points of administration and detail which proved of great help to manufacturers. Of such points possibly the most difficult was that in connection with the valuation of stocks for the purposes of E.P.D., and he hoped that the settlement arrived at of giving all firms an opportunity of re-valuing their stocks as on August 31st was generally regarded as a fair compromise and as removing to a large extent, if not altogether, the great injustice which manifestly must have attended the incidence of E.P.D. in its original form.

Sir Peter referred to the transport problem and to the conferences of the F.B.I. with the Government Department concerned therewith.

In conclusion, Sir Peter Rylands thanked the members of the Federation for their splendid support during his two years of office. The responsibility had been a heavy one, as manufacturers differed in opinion as much as less distinguished people. In laying down his office, he could say of the Federation that it was an instrument of incalculable value for the expression of the views of industry, and if the manufacturers of the country continued to give to the Federation wholehearted moral and material support, it would never be again a reproach to this country that the most vital interest—that of production—was alone silent in the councils of the nation.

Col. O. C. Armstrong (Greenwood & Batley, Ltd., Leeds) was unanimously elected president, and among the new vice-presidents elected was Sir Tom Callender.

The annual report was placed before the meeting and adopted without discussion, as was the balance sheet.

After consideration of some matters of purely domestic interest, the remainder of the meeting was taken up with a discussion of two reports by Committees of the Federation. To be more precise, it should be said that the bulk of the time was occupied by a review of these reports by Sir Peter Rylands, and a little discussion. The Federation has appointed two Committees to deal respectively with trade depression and German reparations; regarding the latter it is claimed the manufacturers of the country have a special claim to be heard. The object in both cases is to place recommendations before the Government.

The Committee which is considering trade depression advances the argument that the policy of Great Britain since the war, of a gradual restriction of currency with the eventual object of reintroducing the pre-war gold standard, has proved not to be the right one, and the unhappy position of industry as a result has been still further aggravated by excessive taxation, as mentioned in Sir Peter Ryland's opening remarks. It is urged that the prime necessity at the present time is not so much a return of the world's currencies to any particular standard of value, or even to any particular ratio to gold, as the achievement of stability at the earliest practicable moment. The Committees' views are well stated in the following paragraphs:—

"We believe, therefore, that an effort must be made to arrive by agreement at some interim arrangement which would provide for a reasonable degree of stability of the principal currencies in relation to commodities, even if this stability could only be maintained for a period, and required periodic readjustment. In view of the experience of the conferences and negotiations of the past few years, it seems to us highly improbable that such an agreement can be reached in the near future by any conference between Governments. The interests which they represent are necessarily so varied and so divergent, and the responsibilities of the Governments themselves so complex, that it is difficult for them to arrive at any practical decision until that decision already has the support of a considerable and influential body of opinion.

"We would suggest, therefore, that discussions should be initiated between the manufacturers of the various countries in the hope of reaching some definite suggestions as to policy which could be urged upon the various Governments with the support of the bulk of industrial opinion in the countries concerned. We suggest that these discussions should be initiated between manufacturers, since the fundamental interests of manufacturers in most countries are identical on this question, and because the existence of highly developed and comprehensive manufacturers' organisations in most countries renders consultations between them on the whole easier than consultation between other groups of interests. As a first step we should recommend that consultation should take place between the manufacturers of this country and of the United States, and if these could reach agreement on any policy which would, in their opinion, benefit the industries of the two countries, further meetings might be arranged between British and American manufacturers and the representatives of the manufacturers of the other leading countries.

"We recommend, therefore, that the Federation should at once ascertain the views of the leading American manufacturers' organisations as to the desirability of such a discussion as we have suggested. If these views are favourable a conference should be arranged, either in this country or America, it being understood that the primary object of such a conference would be to endeavour to arrive at some policy which could be advocated by the manufacturers of all countries with a view to a return to stability in the world's standards of value."

For the rest the Committee recommends the Federation to press upon the Government the urgent need for a substantial and immediate reduction of taxation, and lays it down that a frank statement by the Government that this will be done would do more to restore confidence in trade than anything else.

The second report, dealing with German reparations, starts with the hypothesis that the Reparation Scheme in its present form is incapable of fulfilment, and that the exaction of the reparations cannot fail to dislocate seriously the industries of Great Britain unless special measures are taken to direct the form of payment. It is asserted that the indemnity will eventually be in the form of goods or service, and certain methods are suggested whereby Germany can be made to pay in a manner which will not dislocate British industries. One

is that claims should be made on all German undertakings and property in the form of mortgages or first preference shares to be handed to the Allied Governments. Another is that there should be stricter regulation of the classes of goods and services exported by Germany to avoid, so far as possible, injury to allied industries; whilst another method, to which it is thought sufficient attention has not been given, is that of making Germany carry out constructional works in Allied countries or other countries under Allied direction.

Sir Peter Rylands, amplifying this report, went so far as to suggest that the super-power stations mentioned in the Coal Conservation Committee's Report, which could not now be constructed because of the high cost, might be constructed for almost no capital expenditure in this way, and allow electrical energy to be supplied very cheaply. He also mentioned other directions of a non-electrical character, with which this scheme could be operated in a similar manner, such as the Channel Tunnel.

Not unnaturally the meeting found itself unable to discuss these proposals in detail, and after a more or less non-committal discussion the reports received provisional approbation, and the Council of the Federation was authorised to prepare final reports and act upon them in the way it thinks best.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

North-Western Centre.

The Chairman of the above-named Centre, Alderman W. Walker, delivered his inaugural address at the first meeting of the 1921-22 session at Manchester on November 15th. The following is an abstract of the address:—

The outstanding incident of the past year was the coal miners' strike on account of the effect it had on every branch of the electricity supply industry. At its commencement a few undertakings had ample coal in reserve, many had a little, and others none at all, some of the latter undoubtedly the result of a deliberate decision not to expend money for this purpose, but to rely rather on some Government department's coming to their aid by diverting to them coal belonging to other undertakings. I wish to bring home to those responsible for this policy the exasperation which such action excites. The provision of an ample reserve of fuel is an insurance, although somewhat costly. The cost comprises three factors: deterioration, double handling, and the capital charges on the money which is locked up. For normal-weather deterioration there does not appear to be any radical remedy, nor is the loss from this cause very serious, being 1.2 per cent. for the first year, and 2.1 per cent. for two years. The chief danger is spontaneous combustion, and against this it is necessary to take precautions. Heating is the result of action at the faces of the pieces of coal which comprise the heap, and there is an enormous increase of this area of potential danger as the coal is more and more broken up. Heat generated at the surface of a piece of coal depends largely upon the temperature of the piece, hence the necessity of putting the coal into stock when at a low temperature. The rate of chemical re-action doubles for every 10 degs. F. rise of temperature.

The next item of cost, that of capital charges, cannot be evaded, nor is it subject to any influence exercisable by the engineer. The heaviest item, and the one which in many cases can be reduced, is that of handling. The pneumatic principle has been successfully applied in this country to the transportation of coal, and a parallel development appears to have occurred in Germany during the war, where, however, only small sets of plant have been installed, and some work in the same field has been done in America.

The plant which was put to work recently by Messrs. Henry Simon, Ltd., of Manchester, at the Bankside station of the City of London Electric Lighting Co., Ltd., with a total capacity of 120 tons per hour, is by far the largest in the world.

The drawback which has hampered the progress of the pneumatic plant is its heavy consumption of power. The pneumatic method will only be employed for the solution of that part of a handling problem to which it is particularly adapted. It should never, for instance, be adopted as a substitute for a band conveyor, the efficiency and simplicity of which (within its own range of usefulness) are unsurpassed. In the application of the pneumatic method to the handling of coal I have very great faith. Whereas pneumatic coal handling is historically a development of grain handling, and all the plant installed in England and Germany has partaken of the nature of grain handling plant, pneumatic ash handling has been evolved quite independently and on somewhat different lines. It may fall to power station engineers, having experience of both types, to improve both by a process analogous to cross-breeding.

The class and condition of the coal affect to some degree the efficiency of the plant, and the size of the coal must of necessity be small; it is usual to specify 2 in. as the maximum size, but if the pipe be not too small, and the proportion of small coal be large, lumps of from 4 in. to 6 in. will pass through without difficulty. On the other hand, fine dust may cause trouble if it is very wet. Broadly speaking, a pneumatic plant handles most satisfactorily free-running or "lively" materials. Pneumatic plant is now being installed at the Brimsdown station of the North Metropolitan Electric Power Supply Co.

Experience in grain handling work has revealed an astonishing variety of possibilities in the design of such plant to meet special conditions, including a number fixed on ordinary coal trucks and restricted by the ordinary railway gauge. The utility of such apparatus in dealing with scattered storage dumps will be obvious. I am, indeed, confident that time and experience, whilst doubtless revealing limitations, both technical and economic, must also indicate a continually widening scope for the application of a handling system so flexible and adaptable by its very nature.

Another aid to continuous running during a period of coal shortage is the use of oil as fuel. The recent miners' strike caused a great addition to the number of oil-fired boilers, but apparently the system will be retained on only a few now that coal is again available. It is very difficult to reconcile the notes and figures given by some of those who have made the experiment, but to justify a change from coal to oil the selling price of oil must be a little less than double the selling price of coal. The chief engineer of an undertaking having the largest oil installation in the country has written to me as follows:—

"I am sorry that our results have not been sufficiently conclusive to enable me to quote any definite and satisfactory figures regarding the use of oil firing . . . we have endeavoured to utilise the experience of other users, and also the expert knowledge of all makers of fuel burners, but have had the greatest difficulty in securing consistent results . . . . sometimes we get a good result equal to a boiler efficiency of 85 per cent., and a little more than 15 lb. of water evaporated by 1 lb. of fuel oil, but more frequently we get inferior results, for which we cannot always obtain a reasonable explanation. The whole thing is a tricky business, but will undoubtedly repay careful testing work."

300 degs. F. lower temperature is obtained if steam is used instead of air for atomising; the same quantity of air is required—the steam being so much loading. This does not necessarily mean that it may not be more economical to use the steam direct for atomising instead of for compressing.

The use of town's gas for steam raising has not made any progress, nor does it appear likely that it will do so until a gas-works has been designed and erected with that idea in view. Such an opportunity may come when the second part of the new Manchester electricity station is required, as by that time the gas department will be ready to develop its plans for the new super-gas-works at Partington, the site of which is conveniently near the electricity station. If the fact of a single coal purchasing department effecting a saving in handling costs, the production of valuable by-products, a reduced area of land, less supervision and labour, and all other factors are dispassionately considered, it ought to be possible to arrive at definite conclusions on this very important matter. It is not so simple a problem as is sometimes assumed; the only chance of success would be to take advantage of the construction of new electricity and gas works so combined as to secure the elimination from each of everything which would be done more economically at the other.

The first successful commercial pulverised coal installation of some 20,000 sq. ft. was made in the U.S.A. four years ago. During the first two and a-half years an additional 200,000 sq. ft. only was put into operation, but during the one and a-half years since then 700,000 sq. ft. of heating surface has been installed for burning pulverised coal. The system introduces an entirely new set of conditions into a station, and increases the number of danger points. It is a very marked advance on any other method of burning coal.

The increased adoption of the system in this country appears to depend largely on the essential preparatory plant being made available at prices much below those which have so far ruled. If this can be done there will be a great expansion, and there does not appear to be anything in the plant itself to warrant some of the high prices which have been asked, but of course costly experimental and development work have had to be done.

The labour conditions within the industry are to-day more settled than they have ever been before. The wages and conditions of service for every man in every undertaking in the country were made the subject of an agreement; the duties of each man were defined, and the former state of chaos was ended. Because of the recent fall in the cost of living it became necessary for adjustments to be made, and at a meeting of the National Joint Council in London, consisting of two employers and two trade union representatives from every one of the 13 districts into which the country is divided, I put a resolution for adopting the report of the Negotiating Sub-Committee, by which the wages of the manual workers in the whole industry are automatically regulated for a long period ahead, and it was passed unanimously.

The national and district members have made provision for the technical staff. The two organisations have justified themselves, and I have been told by members of the Ministry of Labour that the completeness of the organisations, the results obtained, and, more than all, the spirit which prevails, are better than those of any other industry.

Concerning the Electricity Commissioners, the greatest and almost universal note of adverse criticism is of the complicated and costly procedure. As one who has placed in them the most implicit confidence I regret that they have been persuaded to put this barrier of costly and complicated legal procedure between themselves and the management of the undertakings.

The Electricity (Supply) Bill No. 2, it is generally agreed, ought to be got through Parliament without further delay.

The committee which considered the Manchester area decided that a J.E.A. without financial powers would be about as useful as a gun without cartridges, so it has recommended the formation of an Advisory Board. It is certain that the Commissioners will not readily grant powers to carry out developments or extensions against the recommendations of the Advisory Board. The technical scheme is thoroughly good, especially so because it resists the temptation to propose a pyrotechnic display of burning power stations in order to make room for super stations, but suggests going slowly towards the realisation of the goal; every step has been carefully considered and all the conditions fully examined and explained.

For the purposes of power and lighting electricity is firmly established in the area, and need fear no rival. As regards private lighting, however, we do not deserve our success. To walk at night through the streets of Manchester and many other towns in the area will provide ample evidence to justify the immediate electrocution of the contractors who have been guilty of the installations. There are in our principal streets example after example of high-power lamps suspended on flex, close up to the window, at the height of the average person in the street, the filaments unscreened, so that the source of the light is almost directly in contact with the eye of the person wishing to examine the contents of the window—every law of illumination broken, and all without a shadow of excuse, either on grounds of cost or necessity. For one good example of lighting there are twenty bad ones, and the sellers of energy ought to be given powers to prevent the abominable misuse of it.

What things are done in the dark recesses of an installation if crimes such as I have just stated can be committed in full light? It is no use saying that the shop-keeper or the householder is at fault; I have ample evidence to the contrary.

North-Midland Centre.

Mr. W. E. Burnand, chairman of the above named Centre, delivered his inaugural address at Leeds on November 15th, on which occasion a smoking concert was also to be given. The following is an abstract of the address:—

The "labour question" is of the first importance and, unless solved in a workable manner, it will not only eclipse but practically extinguish most of our other interests.

It is not very cheering to remember that, although we are professedly Christian, the worst of our labour troubles would be impossible if we were really so. Is it possible to reconcile with the first principle of Christianity—to "do unto others as you would they should do unto you"—most of the causes of trouble at the present time?

Trade unions have done much good work in improving the lot of the unskilled and semi-skilled worker, and much good work remains for them to do, but it seems a great pity that through false and unchristian ideas all the good they have done appears more than likely to be undone on account of trade-union rules. If the trade unions will direct some of their energies in a constructive direction there is employment waiting for them in reconstructing and improving their own country so as to tide over the period—which is not likely to be short—that will elapse before our foreign trade gets into its stride again.

That the capitalist does in his way all that labour does, I am bound to agree in some respect, but I put the unions' imitation of and improvements on these practices first as the cause of the troubles of the working class, because, though both are equally selfish, the capitalist does less harm to the State and to the working man himself.

The idea, of course, is to hit the capitalist, and in this I think they are successful, but labour suffers most acutely since these actions increase the cost of necessities and decrease wages.

Were labour to adopt a more enlightened policy and dismiss the incompetents who style themselves leaders and preach a policy of greed and obstruction which is really disguised industrial suicide, we might see labour hiring capital instead of capital hiring labour, and labour choosing and paying its foremen and managers instead of the capitalist doing so.

The managers and foremen being appointed and paid by the workers would naturally study things from the workers' point of view, and would not try to benefit capital at the expense of labour, but would take a broader view of the whole. Also, since the profit beyond a modest amount paid for the use of capital would go to the workers, and the control would be in their hands, the incentive to efficient production would be so direct that real and substantial profits would be made and the workers themselves would then gradually become the chief capitalists. There will be a strong movement that way within 12 years.

It does not follow that capital would suffer more than under present-day conditions, as in industry capital as a whole is getting no profit at all and is being lost at a much greater rate than it is being made.

The condition of other countries is of vital concern to us, and he is indeed an optimist who can believe in any great revival in these at an early date.

Suppose Germany sells something to us for £1 which would normally cost, say £2. Assuming that this £1 reaches the factory supplying the goods, it will exchange half of this into marks, and will expend the other 10s. outside for raw materials. This factory thus gets, reckoned in its own currency at par value, something like £10 and material of equal value, so the factory prospers on its export trade, even though it has to pay extraordinary prices for raw materials, &c.

But what about the country as a whole? All that goes into the country is £1 or its equivalent, and it has exported goods equivalent to £2, so that it loses £1 on the transaction. Thus, the country as a whole continually gets poorer if a big export trade is carried on. The effect of an adverse rate of exchange is similar to that of a bounty on exports, which may conceivably be a good thing within limits and gives an impetus to exports, but when this bounty increases to 50, 100, or more per cent., the country pays too dearly for the trade thus obtained.

I should not be surprised to find a system of trade by barter, with possibly a limited application of the gold standard, well under way before a really effective medium of international exchange is evolved and utilised. In any case, international trade is crippled for years to come, and in the meantime unemployment remains with us.

There is no one sovereign remedy for this state of affairs, but one of the biggest factors appears to be almost the least utilised—self help. This implies an active personal effort on the part of the worker to look out for and make fresh avenues of employment. Here, again, trade-union policy is purely obstructive. On the employer's part it implies making fresh channels of business, developing inventions, improving plant and the like.

Government action can undoubtedly be of assistance in getting over the present crisis. To rely too much on it, however, is to court disaster with taxes at present rates.

Therefore, above all, we want the principle of self-help and the spirit of Christianity, which, if really and universally prevalent, would soon solve all our financial troubles without devising fresh schemes of payment, Whitley Councils and the like, which are of use in making a little Christianity go a long way and without that little would fail altogether.

We shall develop more on the line of combinations of workers hiring capital and managers, as the fallacies inherent in many theoretical systems become better known. No doubt this may seem in some respects far-fetched, but the day is passing when labour and brains will be controlled by a mentally purblind man seated on a money-bag. Industry has suffered too much through that product of the nineteenth century, the purely "business man" without vision, who has counted as profit all that could be squeezed out of those for the time being under his control. The control of engineering work, for instance, is steadily passing into the hands of men who are engineers as well as money-sorters, to its decided benefit, although if the controlling party loses sight of the ultimate financial side, the last state may be as bad as the first.

In the meantime, it behoves us all as individuals to do what we can to minimise the evils of unemployment and to try to avoid placing the burden on the Government. The best guiding rule is to consider the other man.

The second part of my address deals with relativity, a principle the bounds of which are not yet fixed, but which is having a most profound and widespread influence in the world of physics. It is a great generalization from which many effects, that without it might be obscure and difficult to link up with other effects, can be predicted and defined with ease.

The development of the electron theory concurrently with the relativity theory still further widens the outlook of science on physics. An atom is known to constitute a miniature solar system, an idea which, a few years ago, would have been too far-fetched even to ridicule. About 30 years ago I read a number of so-called occult books. Amidst a lot of loose and many demonstrably wrong statements there was one that occurred in, at any rate, the majority of these books, to the effect—to quote Sinnett's book, on esoteric Buddhism (1885, page 190)—"As it is below, so it is above, wrote the early occult philosophers, the microcosm is a mirror of the macrocosm." (Microcosm means, of course, the minute, and macrocosm the universe.)

Sinnett's book is 36 years old, but the quotation agrees exactly with similar quotations I have seen in much older books, and the original appears to date back to something of the order of thousands of years ago, but is there a clearer summary of the electron theory to-day?

It seems clear that somebody knew something about the subject before we were born, but from the manner in which truth is mixed with fiction, and the absurd with the profound, it appears that some of these early philosophers had interpreters who confused the ideas which they presented and which they did not understand themselves.

The same thing, of course, occurs in modern times.

THE PUBLIC WORKS, ROADS, AND TRANSPORT CONGRESS.

AN I.M.E.A. CONFERENCE.

On November 25th the Incorporated Municipal Electrical Association held a conference in connection with the Public Works, &c., Congress and Exhibition at the Agricultural Hall. At the morning session Bailie W. B. Smith, O.B.E., occupied the chair, and Mr. F. Ayton, M.I.E.E., read a paper on "The Use of Electrical Vehicles for Municipal Purposes." Mr. S. T. Allen, M.I.E.E., presided over the afternoon session, and a paper on "The Application of Electricity Supply to the Municipal Service" was read by Mr. S. J. Watson, M.Inst.C.E., M.I.E.E. *Résumés* of the two papers are given below.

The Use of Electric Vehicles for Municipal Purposes.

By F. Ayton, M.I.E.E.

The principal object of this paper is to correct the prevalent impression that electric vehicles are of low efficiency, complicated, and uneconomical. The usual period for the repayment of loans for the provision of haulage power is seven years; it is therefore necessary that any vehicle purchased should at least have a useful life extending over this time, and that the costs of operation, apart from wages, should be fairly constant. Both steam and electric wagons can meet the first condition, but, as regards the second, variations in the cost of fuel have a much smaller effect upon the "electric's" operating costs than upon those of a steam wagon. The electric vehicle has been shown by extensive practice in America to have a useful life much above the seven-year limit. Figures showing the numbers and ages of vehicles in service in New York indicate that 980 have been employed for eight years; 221 for ten years; 106 for thirteen years; right up to eighteen years for two vehicles. Concerning power costs, the pre-war rates of charge for electricity supply showed an ever-downward trend, and the war did not cause an increase comparable with the increase in the prices of most commodities. It is also to be considered that the demand for power for these vehicles occurs when the load is light, and therefore power is provided merely at the cost of a little extra fuel and oil and repair expenses. It is thus possible to charge a lower rate for this class of supply and still obtain a profit. Evidence of the reliability of the electric vehicle is quoted. Of fourteen of these vehicles at Willesden, running for a full year, one ran without any loss of time; one with only half an hour's loss; one lost an hour; one two hours; and one two-and-a-half hours. The total time lost was only 99.5 vehicle hours, or 0.3 per cent. of the total working time. The "electric" is not so much affected by weather conditions as other wagons; it is as easy to start it when cold as when warm. It is a mistake to think that a vehicle with a low original cost is the cheaper. In Pontypridd a comparison was made between 2-ton electric vehicles and 1-ton Ford vans, and it was shown that the cost per ton of refuse collected was 6s. 5½d. and 8s. 3½d. respectively. Opinions of a number of municipal engineers support this claim of superior economy. Any person of normal intelligence can be taught to drive an electric vehicle in a few hours. This simplicity lightens the repair bill. Although there are more electric vehicles in use in the United States than in this country, comparatively few are employed in municipal service. Mr. J. A. Priestley, Superintendent of Cleansing, Sheffield, says that the history of the progress of electric vehicles in this country is very largely the history of their use in cleansing work. It is also true to say that this class of work is the most rigorous test of any mechanically-propelled vehicle, owing to the frequency with which starts and stops occur. For journeys up to three miles in length horse haulage is probably more economical, but beyond this distance the electric vehicle can be profitably employed. In the opinion of some engineers, however, the electric should be used for all distances. In many cases in which "electrics" have been used for refuse collection the road to the tip has been little better than a morass, and this has resulted in a considerable portion of the energy in the battery being wasted; a good road to the tip should be a prime consideration. The only way to get the best out of a labour-saving machine is to arrange a maximum number of hours of working per day. The "continuous" system in vogue at Birmingham has been found to be the most efficient. The city is divided into districts, and the districts into rounds. Each vehicle has a working list, and commencing on the first house in the list proceeds until it is full. It then returns to the place of disposal afterwards recommencing where it left off. In the summer each round occupies one vehicle for a week, but in winter, when the loads are greater the houses in the area nearest the place of disposal are attended by spare vehicles, which collect the arrears of the previous week. A recent report upon the results obtained by Bootle Corporation in the use of electric vehicles for carting street sweepings and for gulley cleansing states that comparative tests revealed that one electric and five men emptied 80 gullies per day at a daily cost of 2.18s. per gully, as against one horse and one man dealing with 16 gullies per day at a daily cost of 2.68s. per gulley. Electric vehicles are employed for street watering in several towns, notably Blackpool, Bootle, and Ipswich. The Borough Cleansing Superintendent of Blackpool states that, compared with horsed tanks, this method effects a saving of £20 per week. At Bootle the acquisition of a fleet of 13 electrics to replace horses for refuse collection, street watering and general haulage has resulted in a saving of £1,387 per annum after meeting all charges. Several municipal tramway departments have used electric tower wagons with satisfactory results. A number of municipalities use electrics for coal and ash haulage in connection with their electricity works. Electric omnibuses, which are employed in several towns, while highly economical in working expenses, are lacking in sufficient speed. However, the advent of speedier electric 'buses is only a question of a short time. In conclusion, it is impossible to give satisfactory estimates of working costs, as conditions differ widely in various localities. The range of the electric vehicle is limited by the mileage capacity of its battery, but with every improvement in battery design the utility of the electric will be extended. Appendix No. 1 is a list of 90 authorities using electric vehicles, giving the number in use, sizes, purposes for which employed, average daily mileage, number of horses displaced by each vehicle, and period of experience with electrics. The most experienced authority is Sheffield Corporation, which has 45 vehicles, used for refuse collection, with an average mileage of 20-25. Each vehicle displaces four horses, and the Corporation has had six years' experience of electrics. Appendix No. 2 gives notes of appreciation of electric vehicles from 37 engineers.

In introducing the paper Mr. Ayton said that one of the greatest obstacles to the successful use of electric vehicles was apathy. One case had come before him in which the owner of the vehicle had expressed his disappointment with the results. That vehicle was returned to the makers, who found that it had been badly neglected for a long time. That was not the way to get good results, and it was unfair to the Electric Vehicle Committee, which had worked very hard.

Discussion.

Mr. J. A. Priestley (Cleansing Superintendent, Sheffield) said that Sheffield bought its first electric vehicle in 1915, and had been adding to them continually ever since. In addition to 45 electric vehicles used entirely on refuse collection they had an electric tower wagon for tramway purposes and an electric vehicle for taking testing weights, for weights and measures, about the city. Last year they removed 59,000 tons of refuse by electric vehicles at a cost of 9s. 8d. per ton, against 10s. 6d. when the work was done by horses. Last year the vehicles travelled 123,700 miles, and the consumption of electricity was about 1¼ units per mile travelled. The charge was 1½d. per unit, and these vehicles were consumers to the extent of 250,000 units, which represented £1,400, a by no means small revenue for the electrical department, especially considering that the charging could go on at a time when the demand from other directions was small. Therefore it paid the electrical engineer to afford facilities for charging these vehicles. The service at Sheffield was maintained at 90 per cent. efficiency. This could not be said of petrol vehicles which had been in use the same length of time.

Mr. A. J. Makower (Messrs. Mossay & Co.) gave particulars of tests carried out by Captain Cable, of the Westminster City Council, with an electric vehicle on refuse collection. Capt. Cable challenged the statement by Mr. Ayton that the electric vehicle had an assured life of ten years, and said that the evidence in support of that was inconclusive. On the figures in the paper the life seemed to be about 6½ years. He agreed with the author regarding motive power, the present conditions were such as to tell heavily in favour of electricity because petrol was in the hands of a monopoly, whereas electricity was not. With regard to the loss of working time, the evidence in the paper that this was less with electric vehicles than petrol was inconclusive. Mr. Ayton claimed in the paper that he had received 37 expressions of opinion favourable to electric vehicles, but if the replies were analysed it would be found that they could be classified as follows: favourable to electricity against petrol, 4; favourable to electricity against the horse, 4; general opinions expressing satisfaction with electric vehicles of no comparative value, 11; non-committal or no past experience, 14; unfavourable to electricity, 3; unfavourable to electricity but no statement as to what compared with, 1; making a total of 37. These opinions were hardly conclusive in favour of electricity as against petrol. Mr. Makower then gave particulars of tests carried out at Westminster. In the case of a petrol vehicle the cost was £1,000 and that of the trailer £200. The working costs per week were 7s. 10½d. per ton of refuse collected. The figures for an electric vehicle were on the same basis, the cost of the vehicle being £1,160 and the trailer £200. In this case the total weekly working cost was £11 11s. 6d., or 8s. 2d. per ton collected, showing an advantage of 3½d. per ton in favour of the petrol vehicle. The Westminster City Council, however, was in the position of being able to get petrol at very low rates, and, also, the conditions were exceptional. These figures could not be applied to other districts, where the conditions were different. Moreover, the price of energy was 2d. per unit in this case, whereas in many districts it would be 1½d.

Mr. H. W. Wigfield (Cleansing Superintendent, Islington) said that one of the difficulties was that supply was mostly alternating current, and a large expenditure was involved in putting down the necessary converting and charging plant for electric vehicles. In his borough they had spent £5,000 in building a garage, and another £5,000 approximately for plant for charging 11 electric vehicles. The cost of running this plant was £10 per week, or 18s. 2d. per vehicle, in wages alone. Moreover, motor generators absorbed a large amount of power, and as the Islington Electricity Department charged 2½. per unit, it was found that each of the vehicles was costing £12 per week without allowing for maintenance, tires, insurance, and driver's wages, or anything else. He had sent out inquiries to other metropolitan boroughs as to their charges and facilities, and found that seven provided facilities for charging at the electricity works, and also on customers' own premises, three provided facilities on customers' premises only, 13 either did not own electricity works or else provided no means whatever for charging vehicles, and four did not reply. The prices charged varied from 1d. to 2½d. in his own district. Under these apathetic conditions on the part of local authorities and electrical engineers it was impossible to compete with other forms of transport. The Electric Vehicle Committee should see that every large borough and city provided means for charging vehicles at a uniform and economical rate before it asked the public to use these vehicles.

Mr. H. G. Whyatt (Borough Engineer, Grimsby) said he spoke, from experience, whole-heartedly in favour of electric vehicles. The Superintendent of Cleansing had told him that in two months he collected 528 loads of refuse, running 1,848 miles, or 3½ miles per load. With electric vehicles they saved, in two months, 1s. 10d. per ton in collection, which was equal to a 2½d. rate. When the whole scheme got into working order he anticipated a saving of something like 2s. 6d. per ton.

Mr. A. W. Blake (Borough Electrical Engineer, Willesden) said it was essential for salesmen to exercise caution in approaching prospective users of electric vehicles, and not sell vehicles for work for which they were unsuited. In connection with the size of vehicle, they should remember that a 5-ton van cost no more for garage accommodation or to drive it than a smaller one, and the advantages of having the larger vehicle were enormous. He was running certain 5-ton vehicles and a number of 15-cwt. vehicles for house refuse collection, and on a ton-mileage basis he found that with these 15-cwt. vehicles the energy consumed was 2½ units per ton-mile, but the total was 3½, taking into account the loss in the motor generators. There were 14 vehicles on house refuse collection in Willesden, and the total cost per working day was 49s. 6d., including wages, capital charges, and maintenance all round. The loss of time with petrol vehicles was out of all proportion to that of the electric. Some of his vehicles had been running 2½ years, and he was getting 90 per cent. of the original rated capacity of the batteries out of them to-day. His experience was that it paid to have a large battery capacity on the vehicles. Frequent stops did much damage to the batteries, and in selecting the size of battery attention must be paid to the circumstances in which it was to be used.

Mr. T. P. Wilmshurst (Borough Electrical Engineer, Derby) remarked that very little had been said about the initial cost of the vehicles. It seemed to him that the initial cost was far too high, and he asked battery makers and chassis makers to see if they could not produce something which was far more competitive in price with the petrol vehicle. He saw no reason why an electric 'bus should not be got out for short routes which would compete with the petrol 'bus. Then there was need in municipal service for a cheap runabout which would compete with the Ford car, for town work only. He had six vehicles on refuse collection, and his experience was the same as that of previous speakers. The consumption was from 1 to 1½ units per mile, according to the nature of the road.

Mr. Ll. Robinson (Borough Electrical Engineer, Hackney) said that it was very difficult indeed, until they got some work to do, to make a charging station anything but an annual loss; the charging station could not be a paying proposition until there were something like 100 vehicles to deal with. To find the space for that number of vehicles to stand for six or eight hours was an expensive matter in London, and the manufacturers must try and get out a type of battery that could be charged alone and exchanged. At present the vehicle was nearly always charged at its home garage, but it would be very much more economical if vehicles could be provided with suitable batteries and with motors suitably wound so that they could be charged off the standard pressure of the district, by means of resistances, and so avoid wasteful motor generators.

Bailie Smith (Glasgow), who presided, commented on the backwardness of this country with regard to the use of electric vehicles. In 1913, in Chicago, there were 3,000 electric broughams in use, and there was no reason why such vehicles should not find a ready application here; they could be charged in their own garages during the time they were not in use.

Mr. Ayton, replying to the discussion, said that he was sure Captain Cable would be on the side of the electric in a year or two. Mr. Wigfield had good cause for complaint of the prices that were being charged in his borough, and he seriously commended to the Islington Electricity Committee the desirability of doing something to push forward its business on strictly business lines. His experience was that the lead battery, under severe service, would last three years. It was hoped, however, that the cost of electrics would come down, as with every other engineering product, but there was no margin to-day to do it, on a profit-making basis. When the demand came, prices would come down also. Electric 'buses were slow, but an electric battery 'bus could be built which under normal conditions, not in hilly districts, would give speed enough for ordinary conditions. That was using the lead type of battery, which must be used to get good results. With regard to a cheap runabout, he hoped they would be able to get it, but it must be remembered that any new type of vehicle involved a great deal of expense in design, &c. He believed in the future, however, they would get a vehicle which complied with Mr. Wilmshurst's requirements.

The Application of Electricity Supply to Municipal Service.

By Mr. S. J. Watson, M.Inst.C.E., M.I.E.E.

To obtain definite information upon the subject of this paper circulars were sent to 198 local authorities, representing a population of 20,103,000; owing to the short time available for reply only 108 answers were received. The electric lighting of streets, public buildings, schools, and housing schemes is first considered. Good street lighting is a powerful advertisement for an electricity undertaking, and should be the authority's first care, every advantage being taken of each definite improvement. The gasfilled lamp now appears to be the most suitable for street lighting, and the suspension of lamps in the centre of roadways is a step forward in illumination. An important feature of electric street lighting is the ability to centralise the control or switching points; by means of automatic time switches a considerable saving of labour can be effected. One of the reasons for the retardation of changing over lighting to electricity has been the inaccessibility of distributing cables. In many towns there exists an understanding that as the cables are extended the street lighting shall be changed. In two of the towns from which answers were received there are no electric street lamps; in twelve others the lighting is all electric. In the aggregate the figures show that 1,873 miles of streets are illuminated by 55,632 electric lamps consuming 22,601,000 units per annum, while there is 8,635 miles lighted by 245,724 gas lamps. As regards public buildings it has been ascertained that the 108 authorities who furnished details use or occupy 2,307 separate buildings, of which 1,640 are lighted electrically, and the remainder by gas. In 42 towns the whole of the public buildings have electric lighting. So far as schools are concerned the figures received show that of 3,244 schools 1,158 are equipped with electric lighting. Many replies indicate that, as soon as the mains are available, additional schools will have electric light. Statistics regarding electric lighting in new housing schemes are difficult to obtain, but it is seen that in 84 towns no less than 41,663 new houses are or will be, lighted electrically throughout. It is stated that the average consumption per house is expected to be 104 units per annum. It is questionable whether this will cover the cost, but costs might be reduced by employing overhead distribution systems or by the introduction of a tariff which would encourage the use of electricity for purposes other than lighting.

The next point considered is the motor power used by public utilities. In towns where both the gas and electricity undertakings are in the hands of the local authority there is a willingness to co-operate to mutual advantage. In 33 gasworks owned by local authorities there are in use 296 motors, having an aggregate capacity of 4,620 h.p., consuming 1,918,525 units annually. These are used in connection with machinery for charging and discharging retorts, gas compressors and boosters, crushers and elevators, mechanical boiler stokers, &c. The supply of water was among the first to be provided on a communal basis. In most pumping stations low-speed steam engines are used to raise water, but while these have rendered excellent service there are many defects in them. They occupy a great deal of space, buildings are of necessity large, and replacement of parts, although seldom necessary, is expensive. It is not possible, however, to give definite particulars to show where a steam plant has been replaced by an electric pumping plant, although several schemes of this kind are contemplated. Motors to the number of 72, with an aggregate of 3,480 h.p., are used in the waterworks departments of 28 of the authorities circularised. Tramways are, of course, large consumers of electricity. The 1918-19 edition of "Garcke's Manual" summarises as follows: Number of tramways: local authorities, 171; companies, 103; total, 274. Capital expenditure: local authorities, £57,994,000; companies, £24,849,000; total, £82,843,000. Route miles: local authorities, 1,705; companies, 1,015; total, 2,720. Annual consumption (units): local authorities, 452,260,000; companies, 115,840,000; total, 568,100,000. Seven authorities employ 55 railless trolley cars, using about 1,000,000 units per annum. In addition to the transport side, a large amount of electrical plant is used in car-sheds for maintenance and repair purposes, as well as for rail welding and grinding, &c. In the car-sheds of 52 towns there are 302 motors, totalling 3,130 h.p., and using 1,762,000 units annually.

In addition to these main uses of electricity in municipal service there are numerous smaller applications. Development in the treatment of sewage is of comparatively recent

growth; electric motors have been adapted to a large extent for the driving of pumps, screens, air compressors, lime grinders, cranes, conveyors, &c. It is possible to give details of the experience of two authorities in this connection. These authorities installed 13 motors, having a total of 238 h.p., to take the place of steam engines and boilers. The annual consumption is now 364,000 units and 100 tons of fuel, as against 3,050 tons previously. Various other savings, such as in wages, repairs, ash removal, &c., have been effected. Allowing for a charge of 1¼d. per unit and fuel at 40s. a ton, the cost now amounts to £2,850, as compared with £6,100. Fifty-six sewage works are using electricity, there being 289 motors, totalling 5,851 h.p., installed, with a consumption of 4,522,422 units annually. As regards ice manufacture and cold storage there are 18 authorities using 131 motors, with a total of 2,780 h.p.; annual consumption, 3,473,000 units. Seventeen authorities have public bakeries, using 285 motors, with an aggregate of 1,667 h.p. and an annual consumption of 679,794 units. In connection with streets and refuse departments, town's yards, &c., the total number of motors installed is 347. These have a total capacity of 4,365 h.p., and are used for pulverising, brick making, and multifarious other purposes. The annual consumption of energy is 2,653,901 kWh. Electric motors are also used by fire brigades, in public baths, and in other municipal departments. Summing up, the aggregates shown are: motors, 1,881; horse-power, 26,780; units consumed, 20,638,160. These figures are, of course, exclusive of lighting and tramways. The paper concludes with some statistics of gas and steam power employed by local authorities, electric and non-electric vehicles, and electricity supply.

Mr. Watson said that since writing the paper he had received a reply from the engineer of a large urban district council, in which it was stated that, owing to the high value of the refuse in that district it was possible to generate between 4 and 4½ million units per annum and sell this energy to the power company which operated in the borough. In 1919 one unit of electricity was generated for 8 lb. of refuse; there were some undertakings in the country where it would be difficult, with the plant available, to generate one unit for 8 lb. of coal. The amount of refuse burned in the case mentioned was between 25,000 and 26,000 tons.

Discussion.

Mr. F. M. Long (City Electrical Engineer, Norwich) said that electric pumping was being used now instead of gas producer plant for the pumping station. It was the intention to use the motor during the night and on Sunday and make it entirely automatic, so as to save wages, and it had been decided to replace the d.c. motor with a three-phase motor, to be supplied from the 6,600-volt supply. It was estimated that this would effect a saving of £1,162 per annum. The charge for power was 1d. per unit, and this would be a very useful load for the power station, especially as the pumping could be stopped at the time of the peak in the winter. A good deal of electric power was being used at the gas works at Norwich, although the works did not belong to the Corporation. Until recently the works had generated its own power, but the works had been almost entirely rebuilt, however, and the electricity department had been asked to supply. He did not believe in the electricity and gas people keeping at arm's length; they could be very good competitors and at the same time very good friends. The consumption of the gas company was about 40,000 units a year. It was difficult to deal with housing schemes because the demand for electricity was very small; it was probably less than 100 units per annum in Norwich for the small houses. The method adopted in Norwich was to collect 1s. per week with the rents. That was just about sufficient to cover the ordinary use for lighting. There was a risk of its being abused if people had unlimited use, and therefore meters were being installed, so that after 100 units per annum the consumer was charged at the rate of 1½d. per unit, and if the consumption was less than 100, then a rebate was allowed.

Mr. Allsopp (Sales Manager, Bradford) said that all the 600 houses under the housing scheme in Bradford were electrically lighted. The charge was on the basis of 25 per cent. of the rateable value and 1d. per unit. Tenants were gradually being persuaded to use electricity for other purposes, and 1d. per unit was a profitable charge. The gas works took about 250 h.p. from the electricity works, and it was a gratification to know that it was obtained without any pressure from the department. There was also 200 h.p. of electric motors at the refuse destructor works for concrete making and in connection with the disintegrators, &c. The sewage works also used power, and in the driving of a tunnel two miles long for an extension of the sewage system small electric locomotives were used.

Mr. H. G. Whyatt (Borough Engineer, Grimsby) spoke of the saving it was hoped to make by pumping sewage electrically instead of by steam. The present cost was £2,433 per annum, but a scheme had been submitted whereby it was hoped to do it electrically for £1,952. The work of conversion was in course of progress, one of the pumps having been at work two months and the other now being fixed. The price of electricity was £8 10s. per kW per annum and ¾d. per unit, and the total charge for power in October came out to exactly 1½d. per unit. For the housing scheme there was one service for four houses. The houses were designed with gas coppers and gas fires in two bedrooms, but the demand was regarded as likely to be so small that the gas company would not lay mains. Meters were installed in these houses, and a charge of 1s. per week was made in the summer and 1s. 9d. in the winter, but above a certain consumption the charge would be by meter, as mentioned by Mr. Long.

Mr. A. W. Barham (Borough Electrical Engineer, Watford) said that some years ago his Council started a housing scheme with 30 or 40 houses, and there was one service to all the houses and a current limiter to each house; a charge of 3d. per week was made. The owners, however, were putting in cookers and radiators, and a current limiter of 60 or 100 watts capacity was not of much use, and the Council had been compelled to lay services to each house, with a five-ampere meter. He hoped in this way to increase the supply to these houses, but he thought it would be nearer 60 units than 100 units per annum, as mentioned in the paper. He hoped to hire out apparatus, and he was working on the Norwich system, 20s. fixed charge plus 1d. per unit.

Mr. Watson, replying to the discussion, read a letter which he had received from Mr. Fedden, of Sheffield, in which some information was given of the developments in Sheffield with regard to sewage disposal. In an experimental plant at Sheffield it was found that the load factor was over 70 per cent., and a very large scheme had been prepared for Sheffield, in which two motors of a total of 1,000 h.p. would be used, and the consumption was estimated at between 5 and 6 million units per annum. At the Sheffield gas works there were motors of 461 h.p., and a scheme involving the use of a further 242 h.p. was in progress in connection with the installation of vertical retorts. Mr. Watson agreed that the number of units per house mentioned in the paper, viz., about 100, was high, and in 24 replies received since the paper was written the average was 78. At Bury the system of wiring was to lay the mains round the back of the houses attached to the framework, under the eaves. One service was run to every two houses, as they were semi-detached, and that led to a great saving. There had been considerable controversy with the Housing Commissioner with regard to putting in electric lighting and gas cooking apparatus, but eventually both were installed. Considerable economy had been effected by putting in a fireplace in only one upstairs room. In the other two rooms plugs were installed for electric radiators, and this had resulted in a saving of £30 per house, the plugs costing 22s. 6d. each. The Corporation had agreed to keep a stock of radiators for the tenants. A compound system of charging and meters for these houses were essential in order to check wastage.

REVIEWS.

Elements of Illuminating Engineering. By A. P. Trotter. Pp. xi+103; figs. 63. London: Sir I. Pitman & Sons. Price 2s. 6d. net.

This work is a distinct acquisition for those requiring a treatise on the subject dealing only with theoretical considerations. It is usually well written and arguments are succinctly stated: there is no pretence that it is exhaustive, but frequent reference is made to books of greater volume, so that one interested in a particular point and wishing to obtain further information thereon is carefully guided to the proper source. It must be recognised, however, that the practical side of the subject and the possibilities arising therefrom are not dealt with, and it is to be hoped that the distinguished author will supplement the present volume so that a complete and handy reference of theory and applications will be within the reach of all. The size of the book is but small, but therein lies its extreme utility, and Messrs. Pitman's are to be congratulated on producing a series of works which will appeal to those who desire a technical book which may be carried in the pocket without undue bulk, so that it may be digested on odd occasions.

At the outset, Mr. Trotter places before the reader the fundamental definitions and laws relative to the subject, and while some refer to matters highly theoretical, the clarity of expression might be well taken as a pattern by other writers. Vision and glare form the next subjects dealt with, and again one is impressed by the manner in which information is condensed without the omission of salient points. In the following pages, which treat upon the emission of light from a source, there are statements which might be better phrased, especially is this the case with the paragraph at the foot of page 20; there is no reason, however, that should prevent one's obtaining a full understanding of polar curves. The chapter relative to sources of light makes interesting reading and contains much information which is of considerable assistance, though usually omitted from other books on the subject: comparisons are made in an unbiased manner and invite confidence. It may not be out of place to mention here that trade influence is conspicuous by its absence, an unusual feature in a technical work on this subject.

We must confess that the chapter on reflectors and shades left us somewhat disappointed, and we do not always agree with the statements made. For example, the average "reflecting power" of porcelain enamel steel appears to us to be highly stated (page 43): a dispersive distribution is not, to our mind, the same or similar to an extensive distribution: so far as the positioning of the lamp in a "semi-in-

direct" unit is concerned, we have always found that the lamp is best placed so that the filament is level with the rim, the resultant illumination may be very slightly less than the best obtainable, but the general appearance of the ceiling and room is greatly enhanced. Photometers and photometry are handled in a very able manner, without the introduction of details of ultra-scientific and little used instruments. The chapter on planning enables the beginner to appreciate the many methods available for the calculation of illumination, and, at the same time, he will realise the futility of making elaborate calculations when the means at his disposal to convert the paper results into practice are limited by commercial exigencies. After an elaborate exposition relative to the planning of a layout, the author candidly states "of course, in practice, the spacing would be accommodated to suit the arrangement of tools and gangways." The curve (fig. 54) showing the total hours of lighting is capable of misconstruction: if the directions given are followed, the advent of summer-time would appear actually to shorten the hours of darkness!!

There are other minor errors, but generally they are so obvious that they are not likely to be misleading, and will no doubt be corrected in future editions: they do not detract from the work, which we can thoroughly recommend.

Electric Bells, Alarms and Signalling Systems. By H. G. White. Second edition. Pp. 113; figs. 75. London: S. Rentell & Co., Ltd. Price 3s. 6d. net.

This little book, which is essentially of a practical nature, is mainly intended for the use of the wireman and maintenance man, and therefore only describes the apparatus used in sufficient detail to enable its functions to be clearly understood.

Commencing with the simplest bell circuits, the author goes on to describe the more complicated arrangements in use in hotels and other large buildings. The more modern installations show clearly the influence of the telephone engineer in their design, mechanical indicators being replaced to a great extent by relays and signal lamps, which permit of much greater flexibility in duplicating signals and meeting special requirements.

Only the simplest fire alarm systems are described. A full description of any one of the arrangements in use for public fire calls would occupy the whole of the book, and as these systems are almost invariably installed by the firms who specialise in them, the information would not be of much general interest.

The chapter on Mine Signalling Systems has been entirely rewrittten for this edition and now includes the most modern practice. Owing to the new regulations, introduced in 1914, which make it compulsory that the engine man shall receive a visual indication of the nature of the signal, most of the shaft-signalling systems have had to be reconsidered, and at the same time, improvements have been introduced. The author gives a short description of the important features of the principal systems. It is noticed that diagram No. 54 does not agree with the letterpress, which states that a signal given at one point will be repeated at all the other points, whereas with the arrangement in the figure, only the answering signals will be repeated at all the sections.

There is a chapter giving very sensible and practical hints on the best methods of locating faults, and general precautions to be taken in carrying out the work of installation.

The book as a whole is clearly written in simple language, is well illustrated and can be confidently recommended to those interested in the erection or maintenance of the systems described.

Modern High-speed Influence Machines. By V. E. Johnson, M.A. Pp. vii + 278; 93 figs. London: E. & F. N. Spon, Ltd. Price 14s. net.

From the title of this book one might be tempted to conclude that the influence machine had ceased to be a scientific toy, and had become a practical engineering proposition. Such a view obtains but little support from the contents. With one or two exceptions, the machines described are very much on the lines with which we are familiar. Improvements have been made in construction and in selection of suitable materials, and also by the substitution of power drive for the handle and pulleys of the early types, but much remains to be done before the influence machine can be considered as a serious rival to the induction coil for the production of high-pressure electricity.

The first part of the book consists of a description of the early machines of Wimshurst, Holtz, and others, and describes simply the principles on which the action depends. The author then proceeds to describe and illustrate a number of experimental machines which have been made by him during a series of years.

When the amount of work involved in the construction of these machines is taken into consideration, one cannot help feeling that more valuable results might have been obtained by exact experiments on a smaller number of models. It is very difficult to ascertain from this book what are the real outputs and efficiencies of the different types described.

It is true that there are considerable difficulties to be overcome in the measurement of very small currents at high potentials, but even in the case of the power required to drive the machines, which could easily be determined exactly, this does not appear to have been done. An illustration is given of an electrostatic motor which is claimed to develop one-eighth of a horse-power, but the only confirmation of this claim is the statement that it could not be stopped by pinching the axle between the finger and thumb.

The author gives a number of illustrations of practical applications to which influence machines may be put, such as electrotherapeutics, electroculture, wireless telegraphy, &c. He describes at some length an invention by a doctor who proposes to insulate the gas pipes in dwelling houses and use influence machines for maintaining a positive potential at the gas jets, the object being to ionise the air in the rooms.

The first-mentioned applications are being fulfilled at least as well by the induction coil as they could be by the influence machine, and it appears unlikely that there will be a wide field for either in the ionisation of gas jets.

A considerable amount of information is given as to the most suitable materials to be used in the construction of these machines, and the book will prove useful to those who wish to become conversant with the elementary theory or to construct model machines for teaching or experimental purposes.

Modern Central Stations. By Charles W. Marshall, B.Sc., A.M.I.E.E. Pitman's Technical Primers, No. 26. Pp. 115; illustrated. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

This little handbook aims at giving the reader a brief survey of the salient features in connection with the design, construction, and operation of modern steam-driven power stations. The author is careful to point out that in a volume of this size, it is quite impossible to deal adequately with any of the numerous details which are inseparable from a modern power house, but in the reviewer's opinion, the author has certainly succeeded in condensing a remarkable amount of information within the 115 pages forming the volume.

The book is conveniently arranged in nine chapters, dealing successively with factors affecting the choice of plant and site, the coal- and ash-handling plant, the boiler house, the engine room, control gear, and protective gear. The remaining three chapters deal with station operation, power-house plant testing, and an interesting chapter describing the new Dalmarnock power station of the Glasgow Corporation.

In the chapter on coal- and ash-handling plant, the importance of close attention to design to ensure reliability is rightly emphasised, although the problem of coal and ash plant for a modern capital station using low-grade coal on a daily output of, say, even a million kWh, is hardly so easy to solve with inland stations, as is indicated by the author.

With regard to engine-room plant, the driving of the condenser auxiliaries is carefully considered, and alternative methods are put forward, but the system of half-duty units has not been mentioned by the author.

In discussing the question of alternator excitation, no mention of battery excitation has been made with regard to alternative methods.

The chapter devoted to protective gear is a most useful *résumé* of modern practice, and the reviewer feels that it greatly enhances the value of this little volume.

The pages devoted to the operation of central stations and power plant testing should prove of interest even to engineers of ripe experience, and it is pleasing to note that the boiler house comes in for its fair share of attention in these days of costly fuel.

The description of the Dalmarnock power house should prove useful, as its design incorporates most of the salient features of British practice in connection with a modern capital station.

The volume concludes with a page devoted to the bibliography of the subject, but the references can hardly be considered complete with the omission of "Power House Design," by Sir John F. C. Snell.

Altogether the work is an excellent *résumé* of modern British practice, and is well illustrated from photographs of actual plant, whilst the diagrams leave very little to be desired. The book should certainly find a place in the library of both students and trained engineers engaged in the supply branch of the industry.

An Electrical Winding Engine.—Messrs. Fullerton, Hodgart & Barclay, of Paisley, are making two large electrical winding engines for the Powell Duffryn Steam Coal Co., Ltd., South Wales. The total weight of each winder, exclusive of the motor, is 120 tons; it will be one of the largest in South Wales. The drum-shaft, which when completed, weighed 15 tons, was forged at the works of Messrs. Beardmore. The motor for driving the winder is of the British Thomson-Houston Co's. make, and can take a peak load of 2,980 h.p. The depth of the mine shaft for which the winder is required, in about 1,860 feet, and five tons of coal will be taken up every wind in about 72 seconds. The winder is also designed for raising 8¼ tons of rubbish during sinking operations.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

29,625. "Globes, &c., for electric lamps." E. Barnard and Falk, Stadelmann & Co., Ltd. November 7th.
29,634. "Means of regulating electric motor cascades." Siemens-Schuckertwerke. November 7th. (Germany, December 9th, 1920.)
29,635. "Starting three-phase induction electric motors." Siemens-Schuckertwerke. November 7th. (Germany, December 30th, 1920.)
29,642. "Induction motors." Naamlooze Vennootschap Hengelosche Electrische en Mechanische Apparatenfabriek. November 7th. (Holland, May 12th.)
29,663. "Devices for containing electrical conductors, &c." H. H. Longbottom. November 7th.
29,702. "Electro-magnetic driven generator and switching arrangement." F. E. Elsmere, D. E. Evans, H. Morgan, and A. H. Williams. November 8th.
29,707. "Electric beer engine and air compressor." B. Paterson. November 8th.
29,718. "Centrifugal switch." W. Fairweather and Singer Manufacturing Co. November 8th.
29,732. "Electric switch holders for electric lamps." C. G. Bennett. November 8th.
29,752. "Electric fuse carriers, &c." W. T. Henley's Telegraph Works Co., Ltd., and E. Moor. November 8th.
29,754. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). November 8th.
29,756. "Multiplex fuse." P. G. U. Buch and Jensen Trading Co., Ltd. Aktieselskab. November 8th.
29,777. "Electric installations." J. Bethenod. November 8th. (France, November 8th, 1920.)
29,793. "High-tension cable with paper insulation." Allgemeine Elektricitats Ges. November 8th. (Germany, November 8th, 1920.)
29,822. "Electrolytic production of tubes, &c." S. O. Cowper-Coles. November 9th.
29,848. "Electric cables." N. J. Austin. November 9th.
29,865. "Electric conductors." W. B. Sayers. November 9th.
29,868. "Motor-vehicle electric lamps." A. Bunch. November 9th.
29,874. "Dynamo-electric machines." J. H. St. H. Mawdsley. November 9th.
29,880. "Fish-plate tramway, &c., rails." J. Osborne. November 9th.
29,882. "Systems of electric distribution." British Thomson-Houston Co., Ltd., and F. P. Whitaker. November 9th.
29,883. "Illuminating devices." British Thomson-Houston Co., Ltd. November 9th.
29,885. "Electric circuit-breakers." British Thomson-Houston Co., Ltd. (General Electric Co.). November 9th.
29,895. "Apparatus for supplying electricity to instruments or circuits." A. E. Angus. November 9th.
29,918. "Signalling in wireless telegraphy." L. G. Preston and G. Shearing. November 9th.
29,929. "Electric adaptor fitting." L. M. Waterhouse. November 10th.
29,973. "Carriers for electric storage batteries." J. C. Blake. November 10th.
29,979. "Thermionic valves." H. St. J. de A. Donisthorpe. November 10th.
29,989. "Insulating elements." British Thomson-Houston Co., Ltd. (General Electric Co.). November 10th.
29,993. "Means for mounting and driving magneto-electric machines." J. White. November 10th.
29,997. "Dynamo-electric machines." G. Somaini. November 10th. (Italy, November 10th, 1920.)
30,016. "Chains for electroliers, &c." R. D. Best and Best & Lloyd, Ltd. November 10th.
30,036. "Telephone instruments." J. E. Pollak (Siemens & Halske Akt. Ges.). November 10th.
30,059. "Magneto-electric ignition apparatus." R. Bosch Akt. Ges. November 11th. (Germany, May 14th.)
30,065. "Means for handling loads on electrically-driven trucks." C. D. Cuppleditch and J. E. Stott. November 11th.
30,073. "Slings for supporting electric cables." H. E. Hadwen and H. Willis. November 11th.
30,087. "Dynamo-electric generators." J. Neyret. November 11th. (France, March 3rd, 1920.)
30,109. "Wind-driven electric generators." G. F. Mackay and F. E. Shimwell. November 11th.
30,114. "Alternating-current electric instruments for indicating synchronism, power factor, phase difference, &c." C. L. Lipman, Nalder Bros. and Thompson, Ltd. November 11th.
30,118. "Electric cut-outs." H. Penfold. November 11th.
30,121. "Devices for control of railway trains." A. R. Angus. November 11th.
30,136. "Devices for causing electricity to be supplied to instruments or circuits." A. R. Angus. November 11th.
30,140. "Electricity meters." F. Holden and Measurement, Ltd. November 11th.
30,152. "Tapping switches for changing voltage ratios of transformers, &c." E. Barton, C. L. Lipman, S. A. Stigant and Johnson & Phillips, Ltd. November 11th.
30,153. "Tapping switches for changing voltage ratios of transformers, &c." Johnson & Phillips, Ltd., O. E. Scase, and S. A. Stigant. November 11th.
30,158. "Electric cooking utensils." Ehrich & Graetz, F. Graetz, and H. Graetz. November 11th.
30,159. "Electrically-heated coffee-making machine." Ehrich & Graetz, F. Graetz, and H. Graetz. November 11th.
30,160. "Electric switches or controllers for vehicle head lamps." F. C. Curtis. November 11th.
30,183. "Clamping arrangement for sheet-metal stator teeth of electrical machines." Maschinenfabriek Oerlikon. November 11th. (Switzerland, November 17th, 1920.)
30,185. "Electrical relays." S. G. Brown. November 11th.
30,189. "High-frequency electrical coils." L. G. Preston and W. Shuttleworth. November 11th.
30,192. "Electric cycle lamps." C. A. Miller and F. J. Miller. November 12th.
30,193. "Bulb holders for electric cycle, &c., lamps." C. A. Miller and F. J. Miller. November 12th.
30,194. "Electric lighting dynamos." C. A. Miller and F. J. Miller. November 12th.
30,195. "Friction-driven electric lighting dynamos for bicycles." C. A. Miller and F. J. Miller. November 12th.
30,197. "Electric lamps for road vehicles, &c." A. E. Davis. November 12th.
30,227. "Telephone receiver." Western Electric Co., Ltd. November 12th. (United States, December 2nd, 1920.)
30,239. "Electric generator." A. M. Cox. November 12th.
30,242. "Apparatus for use on motor vehicles for rendering electric system inoperative." W. J. Hannah. November 12th.
30,245. "Indicating ringing of electric bells, &c., to operators." F. G. Bell, F. Clark, and Sterling Telephone and Electric Co., Ltd. November 12th.
30,248. "Electric current economiser and regulator." J. E. Savidge and E. L. Terrey. November 12th.
30,251. "Switchgear to control battery charging circuits." G. F. Mackay and F. E. Shimwell. November 12th.
30,268. "Slab inductances for wireless telegraphy or telephony." A. C. Barlow. November 14th.
30,275. "Electric lighting of vehicles, &c." C. R. Cowan and J. H. Goodwin. November 14th.
30,293. "Sparking plug." E. de Waele. November 14th.
30,298. "Electrolytic engine." A. Morrison. November 14th.
30,302. "Electrical apparatus for locating faults in ignition circuits of internal-combustion engines." F. Mead. November 14th.
30,303. "Machine for converting alternating into direct electric current." G. F. Baddeley. November 14th.
30,323. "Vacuum tubes." Franklin Industrie Ges. and J. M. Schmierer. November 14th. (Germany, January 6th.)
30,327. "Electric terminals." British Thomson-Houston Co., Ltd. (General Electric Co.). November 14th.
30,337. "Electric switches." A. H. Mackley. November 14th.
30,338. "Dynamo-electric machines." W. B. Sayers. November 14th.
30,353. "Electrical heating and cooking apparatus." W. W. Nobbs. November 14th.
30,357. "Relay, oscillograph, telephone, automatic current regulator, &c." F. A. Johnsen and K. Rahbek. November 14th.
30,371. "Automatic switches for telephone, &c., systems." Automatic Telephone Manufacturing Co., Ltd. November 14th. (United States, November 23rd, 1920.)
30,372. "Electric alternator." F. Contell. November 14th.
30,397. "Electrical cables, &c." G. D. Roberts. November 15th.
30,424. "Mine signalling systems, &c." Automatic Telephone Manufacturing Co., Ltd., and C. Remmington. November 15th.
30,445. "Electric transmitter microphones." E. D. Young. November 15th.
30,450. "Therapeutic X-ray apparatus." H. J. Monson. November 15th.
30,461. "Method for working electrical gas-purifiers." Lodge Fume Co., Ltd. (Metallbank und Metallurgische Ges.). November 15th.
30,464. "Voltage-regulating systems." A. S. Cachemaille (Westinghouse Lamp Co.). November 15th.
30,508. "Electric water-heaters." H. T. Pointer. November 15th.
30,520. "Electrolysis of acetone solutions." E. F. Morris. November 16th.
30,523. "Electric rivet-heating machines." Buckley, Saunders & Co., Ltd., J. W. Poole, and W. J. Readett. November 16th.
30,525. "Locating fluid leakage faults in underground conduits." R. F. Bellamy. November 16th.
30,548. "Electric insulators." Lodge-Cottrell, Ltd. (Metallbank und Metallurgische Ges.). November 16th.
30,555. "Electrically-driven rotary pumps." J. W. W. Drysdale and Drysdale & Co., Ltd., and J. Young. November 16th.
30,586. "Devices for testing sparking plugs." H. J. Taylor. November 16th.
30,588. "Duplex, &c., telegraphic systems." H. W. Sullivan. November 16th.
30,591. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). November 16th.
30,598. "Combined electrically-driven washing and wringing machine." C. E. Beck and P. B. Taneborne. November 16th.
30,599. "Holders for thermionic valves." A. P. Welch. November 16th.
30,628. "Multiple fuse." J. Szykier. November 16th. (Germany, November 24th, 1920.)
30,630. "Meters for telephone systems." Siemens & Halske Akt.-Ges. November 16th. (Germany, November 20th, 1920.)
30,635. "Electric incandescent lamps." F. Skaupy. November 16th. (Germany, December 4th, 1920.)
30,636. "Electric incandescent lamps." F. Skaupy. November 16th.
30,646. "Electrolytic manufacture of tubes, &c." S. O. Cowper-Coles. November 17th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

11,930. "Electric fly switches." C. A. Damey. April 29th, 1920. (170,873.)
12,475. "Reversing of alternating-current shunt motors." Siemens-Schuckertwerke Ges. April 8th, 1914. (Addition to 2,469/14.) (142,845.)
15,957. "Tuning instruments for use in wireless telegraphy and telephony." H. P. Rees. January 20th, 1921. (170,893.)
16,631. "Dynamo-electric machines." Siemens Shuckertwerke Ges. November 10th, 1914. (145,468.)
16,644. "Magnetic work-holders." O. Coradi & H. Graf-Buchler. June 19th, 1919. (145,471.)
17,564. "Totally enclosed dynamo-electric machines." Siemens-Schuckertwerke Ges. October 7th, 1914. (146,241.)
17,732. "Electrical connecting-devices and lamp-holders." C. J. Marsollier. February 8th, 1916. (145,587.)
17,733. "Electric connecting-devices and lampholders." C. J. Marsollier. June 29th, 1920. (Addition to 145,587.) (170,901.)
17,874. "Magnetos for ignition purposes." E. A. Layton-Smith. June 30th, 1920. (170,902.)
20,227. "Methods of and apparatus for wireless telephony." Dr. E. F. Huth. Ges. & S. Loewe. November 28th, 1916. (Addition to 148,312). (148,313.)
20,230. "Device for checking and recording at the sending station, messages transmitted by wireless telegraphy." Dr. E. F. Huth, Ges. October 21st, 1914. (148,316.)
22,296. "Balanced electrical relays." A. H. Railing, C. C. Garrard and W. Wilson. July 27th, 1920. (170,915.)
22,703. "Reception of wireless signals." H. J. Round. July 30th, 1920. (170,941.)
22,761. "Synchronous motor for polyphase current." Maschinenfabrik Oerlikon. August 26th, 1919. (149,975.)
22,819. "Cooling of dynamo-electric machines." K. Nobuhara. July 31st, 1920. (170,946.)
22,941. "Thermionic valves." A. K. Macrorie & H. Morris-Airey & S. R. Mullard. August 3rd, 1920. (170,953.)
22,942. "Thermionic valves." A. K. Macrorie, T. E. Goldup & S. R. Mullard. August 3rd, 1920. (170,954.)
22,943. "Thermionic valves." A. K. Macrorie, H. Morris-Airey, G. Shearing, & S. R. Mullard. August 3rd, 1920. (170,955.)
23,007. "Magneto-electric machines." British Thomson-Houston Co., Ltd. A. P. Young, & H. W. H. Warren. August 4th, 1920. (170,961.)
23,045. "Combined rectifying and motive-power producing apparatus." W. H. Glaser and W. H. Glaser, Ltd. August 4th, 1920. (170,965.)
24,024. "Process of manufacturing electric insulators." P. J. H. Bernard. August 18th, 1920. (170,980.)
24,262. "Electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co.). August 20th, 1920. (170,984.)
24,565. "Electrically-driven air-compressors." C. A. Vandervell and C. A. Vandervell & Co., Ltd. August 24th, 1920. (170,989.)
25,965. "Operating the electrodes of electric furnaces." J. A. Davey and Electro Metals, Ltd. September 9th, 1920. (171,003.)
26,577. "Electric distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co.). September 16th, 1920. (171,009.)
27,022. "Electric switches." D.M.G.R. De La Pichardais. September 23rd, 1919. (151,613.)
27,510. "Alloy for use in electric heating appliances." G. H. Lofts. September 28th, 1920. (171,019.)
30,986. "Motor-control systems." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.) November 2nd, 1920. (171,037.)
32,217. "Electrical heating device." Maschinenfabrik Oerlikon. November 13th, 1919. (153,908.)

1921.

1,365. "Relays and synchronised clocks or other apparatus actuated thereby." Soc. Anon des Ateliers Brille Frères. September 26th, 1919. (157,438.)